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INTERNATIONAL INSTITUTE OF AGRI
BUREAU OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES

MONTHLY BULLETIN
OF AGRICULTURAL INTELLIGENCE
AND PLANT DISEASES

YEAR V - NUMBER 1 JANUARY 1914

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THE INTERNATIONAL INSTITUTE OF AGRICULTURE.

The International Institute of Agriculture was established under the International Treaty of June 7th, 1905, which was ratified by 40 Governments. Thirteen other Governments have since adhered to the Institute.

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The Institute, confining its operations within an international sphere, shall:

(*a*) Collect, study, and publish as promptly as possible, statistical, technical, or economic information concerning farming, vegetable and animal products, the commerce in agricultural products, and the prices prevailing in the various markets.

(*b*) Communicate to parties interested, also as promptly as possible, the above information.

(*c*) Indicate the wages paid for farm work.

(*d*) Make known new diseases of plants which may appear in any part of the world, showing the territories infected, the progress of the diseases, and, if possible, the remedies which are effective.

(*e*) Study questions concerning agricultural co-operation, insurance, and credit in all their aspects; collect and publish information which might be useful in the various countries for the organisation of works connected with agricultural co-operation, insurance and credit.

(*f*) Submit to the approval of the Governments, if there is occasion for it, measures for the protection of the common interests of farmers and for the improvement of their condition, after having utilized all the necessary sources of information, such as the wishes expressed by international or other agricultural congresses, or by congresses of sciences applied to agriculture or agricultural societies, academies, learned bodies, etc.

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CONTENTS

FIRST PART: ORIGINAL ARTICLES

WAUTERS, P. Instruction in Agricultural Housekeeping in Belgium . . . . . page 1

HAMBERG, H. E. Present Organization of Agricultural Meteorology in Sweden . . » 6

LAVENIR, P. Composition and Agricultural Value of the Arable Lands in the Argentine Republic . . . . . » 9

VINASSA DE REGNY, P. The Study of Agricultural Geology in Italy . . . . . » 19

PATER, B. The Cultivation of Medicinal Plants in Hungary . . . . . » 26

HOWARD. The Profitableness of Present-day Sheep Keeping in Germany, especially in Comparison with Cattle and Pig Keeping . . . . . » 30

SECOND PART: ABSTRACTS

AGRICULTURAL INTELLIGENCE.

I. — GENERAL INFORMATION.

LEGISLATIVE AND ADMINISTRATIVE MEASURES. — 1. New Legislation on Fertilizers, Feeding Stuffs and Insecticides in the State of New Jersey.

DEVELOPMENT OF AGRICULTURE IN DIFFERENT COUNTRIES. — 2. Development of Farming in German South-West Africa. — 3. Agriculture in the Belgian Congo.

RURAL HYGIENE. — 4. Hygienic Organization of Workers in the Tropics.

EDUCATION AND EXPERIMENTATION IN AGRICULTURE AND FORESTRY. — 5. Agricultural Instruction for Soldiers. — 6. The Agricultural and Veterinary College at Rio de Janeiro, Brazil. — 7. Agricultural Demonstration Train at Rosario de Santa Fé (Argentina).

AGRICULTURAL INSTITUTIONS. — 8. The Société Nationale d'Agriculture de France..

AGRICULTURAL SHOWS AND CONGRESSES. — 9. Agricultural Shows. — 10. Agricultural Congresses.

II. — CROPS AND CULTIVATION.

a) GENERAL

SOIL PHYSICS, CHEMISTRY AND MICROBIOLOGY. — 11. The Selection of Land for Plantation in the Tropics. — 12. The Soil Solution and the Mineral Constituents of the Soil. — 13. The Influence of Salts Common in Alkali Soils upon the Growth of the Rice Plant. — 14. Culture Experiments on Sick Soils.

MANURES AND MANURING. — 15. Enrichment of Farmyard Manure by Cake Feeding. — 16. Decrease of Available Phosphoric Acid in Mixed Fertilizers containing Acid Phosphate and Calcium Cyanamide. — 17. Degree of Fineness of the Lime used for Dressing Land. — 18. Sulphur and Pyrites used as Manure.

b) SPECIAL

AGRICULTURAL BOTANY. — CHEMISTRY AND PHYSIOLOGY OF PLANTS. — 19. Research on Vegetable Physiology. — 20 The Water Requirement of Plants in the Great Plains. — 21. Occurrence of Aluminium in Plants. — 22. Study of the Methods of Estimation of Carbohydrates, especially in Plant Extracts. — 23. Analysis of Willow Ashes. — 24. The Stomatal Characteristics of Varieties of Sugar Cane.

PLANT BREEDING. — 25. The Importance of the Structure of the Ear in the Selection of Maize.

ROOT CROPS. — 26. *Tacca umbrarum :* a Starch-producing Plant in Madagascar.

OIL CROPS. — 27. The Oil Palm. — 28. Gru-gru Palm Kernels (*Acrocomia sclerocarpa*) in Trinidad.

RUBBER, GUM AND RESIN PLANTS. — 29. The Rubber Crisis. — 30 New Method of Tapping Manihot.

VARIOUS CROPS. — 31. Tobacco in the French Colonies. — 32. Turkish Tobacco in the Cape Province. — 33. Cultivation of the Rose Geranium and its Present and Future Economic Conditions. — 34. Note on a Lemon-Grass from Fiji. — 35. A Perfume Plant from West Africa : *Popowia Capea*. — 36. Anatomy of the Seed of *Abrus precatorius* and of the Seeds Used to Adulterate it.

MARKET GARDENING. — 37. The Forcing of Spanish Iris.

FORESTRY. — 38. Forest Protection in Canada. — 39. The Palmyra and Dum Palms in West Africa.

III. — LIVE STOCK AND BREEDING

a) GENERAL.

HYGIENE. — 40 Malignant Oedema in Sheep.

ANATOMY AND PHYSIOLOGY. — 41. Studies of the Endogenous Metabolism of the Pig as Modified by Various Factors.

FEEDS AND FEEDING. — 42. New Method for Calculating the Value of Foods from the Point of View of the Production of Milk.

BREEDING. — 43. Study of the Correlation between Racing Performances and Breeding Value in Brood Mares. — 44. Colour Inheritance in Swine.

ENCOURAGEMENT OF BREEDING. — 45. Stock-Breeding in Tripolitania. The Export of Stock and of the Products of the Stock-Breeding Industry.

b) SPECIAL

CATTLE. — 46. Studies in Milk Records. — 47. Comparative Investigations into the Performance of the Breeds of Cattle kept in the Province of Saxony, Prussia. — 48. The Freiburg Pied Mountain Cattle and their Employment for Crossing with the German Black-spotted Lowlands.. — 49 An American View of the Beef Cattle Situation.

FISH. — 50. On the Relation between the Fat Content and Natatory Power of Fish.

OTHER LIVE STOCK. — 51. Fur-Farming in Canada.

IV. — Farm Engineering

Agricultural Machinery and Implements. — 52. Experiments with Meyenburg's Motor Cultivator. — 53. Motor Plough Trials of the German Agricultural Society at Klein-Wanzleben. — 54. Maillet's Motor Tilling Machine. — 55. Trials of a "Universal" Spring-Tooth Cultivator. — 56. Spring-Tooth Harrows. — 57. Threshing with Steam Engine or with Electric Motor. — 58. Trial of a Roller Mill. — 59. Review of Patents.

V. — Rural Economics.

60. Some Profitable and Unprofitable Farms in New Hampshire. — 61. The Private Economic Conditions of Moravian Peasant Farmers. — 62. Farming Conditions in the Department of Puy-de-Dôme in France. — 63. The Profitableness of Milk Farms.

VI. — Agricultural Industries.

Industries depending on Animal Products. — 64. Summary of the Results of Researches made during the Last Few Years at the Dairy Institute at Alnarp (Sweden). — 65. Determination of the Amount of Water added to Milk based on the Degree of Acidity. — 66. The Relationship between the Bacterial Flora of Milk and of the Pasture. — 67. The Composition of Ewes' Milk Sold in Hungary. — 68. Complete Churning and Questions Connected with it. — 69. Promoting the Formation of Eyes in Emmental Cheese.

Industries depending on Plant Products. — 70. The Use of Hydrosulphites in the Manufacture of Beet Sugar.

PLANT DISEASES.

I. — General Information

Legislative and Administrative Measures for the Protection of Plants. — 71. Modification of the Laws on Phylloxera Control in Italy.

I. — Diseases not Due to Parasites and of Unknown Origin.

72. Partial Damages of Frost on Winter Cereals Resembling Damage by Wild Animals.

III. — Bacterial and Fungoid Diseases.

a) General

Fungoid Diseases. — 73. he Occurrence of Rust Spores in the Interior of Wheat and Barley Grains. — 74. Contribution to the Biology of Naked Smut of Barley (*Ustilago nuda*).

Means of Prevention and Control. — 75. *Cicinnobolus* sp. Parasitic on Apple Mildew (*Oidium farinosum*).

b) Special

Bacterial and Fungoid Diseases of Various Crops. — 76. Diseases and Pests of Plants in Belgium in 1911 and 1912. — 77. Inquiry and Observations on Straw Blight of Wheat in the Department of Aisne, France. — 78. *Stilbum flavidum* Parasitic on Coffee, and its Systematic Position. — 79. *Fusarium bulbigenum* on Narcissus Bulbs. — 80. The Rotting of Bunches of Grapes produced by *Phoma* sp. in Algeria.

IV. — Parasitic and other Injurious Flowering Plants.

81. On the Germinating Power of Seeds of *Orobranche crenata* after Passing through the Digestive Tracts of Cattle and after Fermentation in the Dung. — 82. *Fagopyrum tataricum* as a Weed among Buckwheat in Volhynia, Russia.

V. — Insect Pests.

a) General

Generalities. — 83. First Annual Meeting of the " Deutsche Gesellschaft für angewandte Entomologie ".

Means of Prevention and Control. — 84. *Bacillus Gortynae, B. Pyrameis* I and *B. Pyrameis II*, parasitic on the Larvae of *Gortyna ochracea* and *Pyrameis cardui*. — 85. The Acclimatization of *Novius cardinalis* in France.

b) Special

Insects and other Invertebrates Injurious to Various Crops. — 86. Injurious Insects and Other Animals Observed in Ireland during the Year 1912. — 87. The Serpentine Leaf Miner (*Agromyza pusilla*) Injurious to Alfalfa and Other Crops in the United States. — 88. The Metallic Flea Beetle (*Haltica pagana*), a New Pest of Strawberries in Victoria (Australia).

VI. — Injurious Vertebrates.

89. The Control of Voles in the Val di Chiana, Italy.

The Bureau assumes no responsibility with regard to the opinions and the results of experiments outlined in the Bulletin.

The Editor's notes are marked (Ed.).

FIRST PART.

ORIGINAL ARTICLES

Instruction in Agricultural Housekeeping in Belgium

by

P. WAUTERS,

Subinspector at the Ministry of Agriculture and Public Works.

I. — AIM OF AGRICULTURAL HOUSEKEEPING INSTRUCTION.

While the spread of agricultural instruction exercises a favourable influence on the increase of agricultural production, the special instruction of women engaged in rural pursuits tends not only to increase the material resources of the farm, but also to raise the social level and improve the general well-being of the cultivator. Is it not the duty of the farmer's wife to look after the upbringing of the children, to provide nourishing and appetizing food for the family, to keep the house in good order from an aesthetic and a hygienic point of view and to see to the general comfort of her family?

All these considerations have been taken into account in the organization of agricultural housekeeping schools in Belgium; they are not ordinary schools of domestic economy for country girls, but rather technical institutes for the training of future farmers' wives, where they acquire a knowledge of and devotion to their profession.

Agricultural instruction for girls, begun twenty-three years ago, has extended rapidly and there are indeed few countries in which this organization is so well developed as in Belgium.

These schools can be classed as permanent or fixed, and temporary or travelling.

II. — PERMANENT SCHOOLS.

These consist of three types: A, Agricultural Housekeeping Schools; B, Agricultural Housekeeping Sections; C, Elementary Technical Agricultural Sections.

A. Agricultural Housekeeping Schools. — There is no agricultural instruction of a higher or university standard for girls. The permanent farm schools give instruction of a secondary standard. They aim at giving a sound technical education suitable for young women intending to take up agriculture. The instruction comprises a theoretical and practical course in the following subjects: Natural History, elements of Agriculture, Kitchen Gardening and Flower-growing, the elements of Animal Husbandry, Dairying, Domestic Economy, the elements of Pedagogy and Hygiene, the elements of Commerce and Book-keeping. There are also occasionally Courses in Common Law and Social Economics.

The courses are generally divided into two years of study.

The development of this scheme, its internal organization and the relative importance of the theoretical and practical work are not the same for all schools. The scheme and detailed time-table of instruction are submitted for the approval of the Minister of Agriculture. The following is a scheme of practical work for one of the schools :

In groups of from 4 to 6 the pupils take their turn in feeding the live stock, milking the cows, calculating the feeding value and price of the rations, learning to recognise the good and bad points of live stock, making butter and cheese, and analysing the dairy products. They also take charge of the poultry-yard, superintend the hatching of chickens both artificially and naturally, and undertake the rearing of poultry, fattening of pullets and their preparation for the market. They take charge of the apiary, take the swarms, gather the honey and the wax and prepare hydromel. They grow vegetables and flowers, prune fruit-tres, prepare jams and preserved fruits, make wine and various beverages from garden fruit, and keep accounts.

In Domestic Economy they make and repair clothes, wash, bleach and iron linen, prepare meals, and are responsible for the decoration of the houses and gardens.

At these schools, the instruction is entirely free, but the pupils pay for their board. They keep a strict account of the income and expenditure of the establishment ; each month an account is made out for each member, either mistress or pupil, who then contributes her share.

There are thirteen such schools in Belgium : Bastogne, Berlaer, Bouchout, Brugelete, Celles, Gortemarck, Cooreind, Gijseghem, Héverlé, Herve, Overijsche, 'S Gravenwezel, Virton, Wavre-N. Dame. With the exception of those at Bouchout and Virton all these schools are under one central institution of general instruction.

The Department of Agriculture contributes to the expenses according to the scheme of development, the value of its staff of instructors, and the importance of the station and its equipment, by subsidies varying from 1000 to 4000 francs (£40 to £160).

The age of admission for pupils is 14. To facilitate study and to avoid loss of time in taking notes the pupils are provided with type-written summaries or they make use of text-books. These are also useful for women who wish to study at home.

At the end of the course the pupils may be examined before a board composed of a delegate from the Department of Agriculture, a delegate from the province (in cases where the school is subsidised by the provincial government), and members of the staff.

To encourage attendance, the public authorities offer scholarships to pupils. The Department of Agriculture also offers scholarships to students on the application of the candidate and the recommendation of the examining board. Certain provinces include an annual allowance in their budgets for distribution as scholarships for pupils of particular schools.

B. Agricultural Housekeeping Sections. — These aim at inculcating a taste for agriculture and at the same time imparting general instruction. The course corresponds to a lower secondary standard.

The technical instruction and the practical work is more limited than in the true agricultural housekeeping schools. The scheme of work comprises elements of Agriculture, Dairying, Domestic Economy and Bookkeeping. Four hours per week are devoted to theoretical and about the same to practical work. The government subsidies amount to 750 to 1000 francs (£30 to £40) per year for each section. Sections are established at Champion, Jodoigne, Maulde, Tessenderloo and Waremme.

C. Elementary Agricultural Sections — The foregoing courses are for girls who can put in at least one full year's study, whilst these elementary sections are intended for the children of small holders, who have to assist their parents in farm work at an early age.

In general they are in connection with public or private elementary schools and the scheme of work is capable of modification according to local conditions. Thus there are some which work only during the slack period in the farm work, others for one afternoon per week throughout the year, others in the evening or on Sundays..

Attendance at these courses is gratuitous. The Departments of Science and Arts and of Agriculture may collaborate in the organization of these sections. The former makes grants to the adult schools, while the latter gives an annual grant of 350 to 750 francs (£14 to £30) and pays half the expenditure of the necessary equipment for the course in agriculture.

Elementary sections for girls, of recent creation, are as yet only 10 in number, but it may be safely predicted that, when better known, they will rapidly increase, for they are destined to render valuable services to the rural population.

These courses are already in existence at Appelterre, Borsbeke, Hélélé, Terbanck, Iseghem, Resseghem, Rondu, Salmchâteau, Vezon, Vorst and Zeelhem.

III. — Temporary or Travelling Schools.

The temporary agricultural housekeeping schools are moved two or three times a year from one canton to another, and form one of the most interesting features of agricultural education in Belgium. When

they were started, in 1890, they immediately met with great success. These schools were originally founded for the development of the national dairy industry, and their first object was a rapid dissemination in the country districts of the best methods of utilising milk and of making butter and cheese. At present the session lasts four months, and the course comprises Crops, Live Stock, Dairying, Cheese-making, Domestic Economy, Poultry-keeping and Book-keeping.

These schools are provided on the request of the community, or of an agricultural organization or society, with the pecuniary assistance of the State, the province, the community or the agricultural society. The budget of these schools reaches about 2 500 francs (£ 100) for a session of four months.

The instruction given is theoretical and practical and the classes are held every week-day, two hours being devoted to theory and three to practical work. All the pupils are external, the maximum number not exceeding 20. Attendance at the course is entirely free.

In order to be admited to the classes, girls must comply with the following conditions : 1) age 15 ; 2) possess a good elementary education attested by a certificate ; 3) physical fitness for the work. The staff of instructors consists of 1) a director, who gives the course in Crops and Live Stock and is responsible for the organization of the school (these positions are filled by State agriculturists) ; 2) two resident mistresses, who give the courses in Domestic Economy, Dairying, Cheese-making and Book-keeping ; they also direct the practical work. The mistresses receive a fixed salary paid by the State. During the period when the schools are closed, they give lectures and public courses for farmers' wives.

For practical work, all the schools are furnished with appropriate material (separators, churns, butter-workers, refrigerators, butyrometers, cheese-making utensils, cooking utensils, lye-washers, sewing-machines, etc.).

At the end of each session an examination is held in all the branches of instruction and in practical work. The examining board consists of the staff and a delegate from each authority patronising the school. Since the foundation of these schools, more than 6 000 girls have received diplomas.

At present there are thirteen such schools in the country, distributed as follows :

Province	Number
Antwerp	2
W. Flanders	2
Brabant	1
E. Flanders	1
Liège	1
Limbourg	1
Luxembourg	3
Namur	2
Total	13

The success of these schools is generally much greater than that of the permanent ones. Owing to the scarcity of labour in the country the small or average cultivator has difficulty in sending his children to school for one or two years about the age of 15. The travelling school, lasting only 4 months, may be said almost to carry the instruction to the pupils' homes, with the result that they are more easily got together.

It is often found that when a new session is opened in a place where one has already just been held the applications for admission are more numerous, which shows that the farmers' wives appreciate the technical instruction as soon as they get to know it.

IV. — Lectures and Farm Women's Circles.

The organisation of public lectures and the creation of farm womens' circles are the most successful of all methods for the rapid diffusion of technical instruction of women in the country. They constitute a real extension of agricultural housekeeping education.

For two years the Department of Agriculture has been organising *lectures* on various subjects of interest to farm women: provisioning the household, management of the kitchen and fruit garden, preservation of fruits and vegetables, feeding of live stock, dairying, poultry-keeping, hygiene, etc. These lectures are instituted on the recommendation of State agriculturists or on request from an association of farm women. Everywhere they are accorded the warmest possible welcome, and the average attendance is as high as 70.

The *farm women's circles*, are associations of country-women, who, by means of lectures, the institution of libraries, and competitions, attempt to circulate the information necessary to the proper management of a rural household or farm. To organize a circle, a large number of members is not necessary to begin with. Very often it is sufficient to call together some old pupils of agricultural housekeeping schools and a few intelligent country-women, to explain to them the aim of the periodic meetings and to submit to them a very simple draft of rules.

If the circles wish to become proprietors of various objects, they are granted the legal form of a professional union. The resources are made up from members' subscriptions (generally very small) and from gifts of patrons. Public authorities may assist by organizing lectures, libraries and competitions.

In six years 183 circles have been formed, with a membership of 21 500. In 1912 the farm women's circles organised 806 meetings. The circles are united to form federations, three of which run journals.

V. — Conclusion.

Agricultural housekeeping instruction has rendered and still continues to render most valuable services to the agricultural population of Belgium. As yet, however, it only reaches a select few, representing less than 1 per

cent. of the girls who might profit by it. Thus it is by increasing the numbe of easily accessible schools and popularising the methods of scientifi agriculture that improvements in the conditions of rural life and the rai sing of the dignity of the agricultural profession can be effected. When th farmer's wife has realised the fullness of her duty and learnt a better ap preciation of rural life, and her daughters no longer seek to leave the country the young men will be more ready to take up an agricultural life.

Present Organization of Agricultural Meteorology in Sweden

by

Prof. H. E. HAMBERG,

of the Central Meteorological Institute, Stockholm.

The Swedish Meteorological Service in the continental part of the coun try is chiefly centralized at the Central State Meteorological Institute whic depends, from an administrative point of view, from the Royal Academ of Sciences and has been at work since 1873. There is besides a Meteoro logical Observatory of the first class at Upsala depending from tha University.

There is no special service for agricultural meteorology at the Centra Meteorological Institute. But an endeavour has been made to organiz the observations in the numerous stations, as well as their publicatio and in general the whole service, in such a manner as to give satisfactio not only to the many requirements of the public in the matter of meteor logical intelligence of all kinds, but also to the agricultural classes. Wit this object in view, the Institute has naturally tried to conform to th resolutions taken from time to time by the International Meteorologic Congresses and committees.

In the interests of agriculture the Institute's activity consists in : daily meteorological service ; 2) regular observations of the temperatu and hygrometric state of the air, direction and velocity of the wind, dur tion of sunshine, degree of cloudiness, rain and snowfall ; 3) observatio on storms, state of the ice, and on phenomena interesting the animal a vegetable kingdom and agriculture.

1. — For the daily meteorological service the Institute receives throug out the year telegrams giving meteorological observations taken in the eve ing and in the morning by 16 home and 68 foreign stations, in all 84. W the assistance of all these telegrams two synoptic charts are drawn up dai the morning one being exposed to the public in five places in the capit The most important observations contained in the morning telegrams communicated to 9 daily papers of the capital under the form of a tal accompanied by a summary of the state of the atmosphere and by a fo

cast for the following 24 hours. Three of the papers with the widest circulation publish meteorological charts.

The summary and the forecasts are telegraphed between 11 o'clock and noon to those communes who pay a fixed subscription for this purpose to the telegraph administration. A shorter summary, as well as the forecasts, is also sent to the managers of the State railways, who expose them to the public in all the large stations. This arrangement has also been adopted by several private railway companies. This intelligence is also communicated by telephone to private persons.

In July, August and September a special afternoon meteorological service is oganized for the benefit of agriculture. For this purpose the Institute receives during the above period the morning telegrams containing the observations made in the evening and in the morning of 6 other home and one other foreign stations, as well as the afternoon telegrams from 17 home and 19 foreign stations. The forecasts that are drawn up by means of these telegrams are published between 5 and 6 p.m.; they are hung up to the public in five places in the capital; they are communicated to the newspapers and spread like the morning intelligence by means of the telegraph and telephone.

2. — The observations on the temperature and hygrometry of the air, direction and velocity of the wind, cloudiness and amount of sunshine, are made regularly three times a day in 37 stations of the second class kept by the State, and by a small number of private stations (8 in 1912). In these stations readings are also taken of maximum and minimum temperatures, of the snow and rainfall, as well as observations on storms, hail, fog, etc. The observations of 18 stations are published in full in the collection called "Swedish Meteorological Observations", published since 1859, with a new series since 1873; those of the other stations are given under the form of annual tables. In this publication the monthly reports of about a hundred private stations of the third class (about which more below) are inserted.

A network of stations of the third class, for the most part private, has existed since 1878, especially for rainfall reading and also for observations on the temperature of the air, and if to these be added about 40 stations in lighthouses in which the amount of rainfall and temperature are observed, as well as the hydrographic stations which have been established during recent years, a total of 633 raingauge stations is reached for the year 1912. The quantity of monthly rainfall, the maximum for 24 hours, as well as the number of days with rain, snow, storm and frost (minimum below freezing point) are noted in the periodical bearing the title "Swedish Monthly Meteorological Bulletin in the Interests of Agriculture" (33rd year, 1913). Each number contains a chart showing the quantity of rainfall, and a certain number of tables on the temperatures of the air and the soil, and the winds, besides communications from observers, etc.

3. — Besides the observations mentioned above and which are mainly made by instruments, several persons observe certain phenomena which are of interest to agriculture (storms and the state of the ice), as well as phenomena in the vegetable and animal kingdoms (phenological observa-

tions) and in agriculture. Night frosts dangerous to vegetation were equally noted by these observers ; at present they are set forth (since 1881) in the monthly bulletins of a certain number of rainfall stations. This system of stations, called fourth class stations, was organized in 1871 by Professor H. H. Hildebrandsson at Upsala, and was adopted in 1881 by the Central Meteorological Institute. Nevertheless, owing to want of funds wherewith to pay them, the observers of phenomena in the vegetable and animal kingdoms are now not numerous.

Besides the periodicals mentioned above as works that may be important to agriculture from the meteorological point of view, the following may be noticed.

H. E. HAMBERG. La température et l'humidité de l'air à différentes hauteurs observées à Upsal pendant l'été de 1875. — *Nova Acta Reg. Soc. Sc. Ups.*, Series III, 1876, 37 pages, 1 pl. Upsala, 1876.

H. H. HILDEBRANDSSON. The storms in Sweden 1871 - 1875 (in Swedish). Supplement to the *Mémoires de l'Académie Royale des Sciences de Suède*, VI, No. 13, 22 pages, I pl. Stockholm, 1877.

H. H. HILDEBRANDSSON and C. A. RUNDLUND. Prise et dèbâcle des lacs en Suède, automne 1871-printemps 1877. — *Nova Acta Reg. Soc. Sc. Ups.*, Series III, 1878, 8 pages, 3 pl. Upsala, 1879.

H. W. ARNELL. The Development of Vegetation in Sweden from 1873 to 1875 (in Swedish). — *Annales de l'Université d'Upsal*, 1878, pages 84, 3 pl. Upsala, 1878.

H. H. HILDEBRANDSSON. Marche des isothermes au printemps dans le nord de l'Europe. — *Nova Acta Reg. Soc. Sc. Ups.*, Series III, 1880, 10 pages, 3 pl. Upsala, 1880.

A. C. HÖGBOM. Marche des isothermes en automne dans le nord de l'Europe. — *Nova Acta Reg. Soc. Sc. Ups.*, Series III, 1883, 8 pages, 4 pl. Upsala, 1883.

H. E. HAMBERG. Le l'influence des forêts sur le climat de la Suède I-V. Supplément du rapport de l'Administration des Domaines sur les forêts, Années 1884, 1887, 1895 (in Swedish and in French). I et II: Organisation et température, 76 pages, 1 pl. ; III: Humidité de l'air, 58 pages, 1 pl.; IV et V: Eaux tombées, et couche de neige, 128 + 36 pages, 18 + 12 pl. Stockholm, 1885, 1889, 1896.

H. MOHN and H. H. HILDEBRANDSSON. Les orages dans le peninsule scandinave. — *Nova Acta Reg. Soc. Sc. Ups.*, Series III, 1887, 55 pages, 12 pl. Upsala, 1888.

H. E. HAMBERG. Die Sommernachtfröste in Schweden 1871-1900. — *Mémoires de l'Académie Royale des Sciences de Suède*, Vol. 38, No. 1, 94 pages, 5 pl. Stockholm, 1904. — The memoir contains also average dates for certain epochs in the development of vegetation, especially in their bearing on agriculture.

H. E. HAMBERG. Moyennes et extrêmes de la température de l'air en Suède 1856-1907. Supplément aux Observations météorologiques Suédoises publiées par l'Académie Royale des Sciences de Suède, Tome 49, 2e série, Vol. 35, 1907, 81 pages, 20 pl. Upsala, 1908.

H. E. HAMBERG. Les Pluies en Suède de 1860 à 1910. — Supplément aux *Observations Météorologiques Suedoises*, Vol. 52, 1910, 215 pages, 16 pl. Upsala, 1911.

Composition and Agricultural Value of the Arable Lands in the Argentine Republic.

Part I : Provinces of Buenos Aires and Santa Fé.

by

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GENERAL CONSIDERATIONS.

The vast territory of the Argentine Republic, estimated at 1 139 800 square miles, extends from 21° to 54° S., that is to say from the tropics to the southern cold zone. It possesses a mountain system occupying a relatively limited area ; this consists of the great mass of the Andean Cordillera, the principal summits of which mark the boundary line on the west between Argentina and Chile.

Apart from the important groups of mountain chains connected with and nearly parallel to the system of the Andean Cordillera, which occupy the provinces of Jujuy, Salta, La Rioja and a part of Tucuman in the north, only a few isolated massifs occur in this immense country ; such are those in the centre of the country in the north of the provinces of San Luis and Cordoba and some sierras of less importance in the south of the province of Buenos Aires. The rest of the country consists of immense plains called " pampas ", the monotony of which is only relieved in certain districts by slightly elevated undulations, or in the more sandy regions by some dunes fixed by vegetation or by others still shifting.

The alluvial soils of which these plains are formed sometimes attain a considerable depth, as in the north and centre of the province of Buenos Aires and the south of Santa Fe and Cordoba ; no pebbles occur in them, and most of them, at least in the upper strata, contain no " fine gravel " ; it is only in exceptional cases that the whole of the soil will not pass through a 1 mm. sieve. They are in general rather fine soils, the " coarse sand " being almost always inferior in quantity to the " fine sand ; " the clay content is very variable, and in consequence the soils vary from very heavy to very light, and some are even shifting.

A good idea of the distribution of the soils in the most cultivated part of the country — the part which we are going to describe (1) — may be had by

(1) It comprises the provinces of Buenos Aires, Santa Fe and Córdoba, the Pampa territory, and the provinces of San Luis, Mendoza, San Juan and Santiago del Estero, or a total of about 300 million acres.

starting from Buenos Aires and turning towards the west, following for example the Pacific railway which crosses the country almost in a straight line for a distance of about 650 miles ; in a belt along the coast the soil is found to be fairly heavy, becoming gradually lighter as the boundary between the provinces of Buenos Aires and Cordoba is approached ; in the south of this province and in the province of San Luis it becomes sandy, as it does also, though to a lesser degree. in that of Mendoza. It is the same in going from Buenos Aires into the south-west of the province and as far as the Central Pampa, but matters change on travelling northwards parallel to the Rio Parana ; thus the somewhat heavy soils of the south of the province of Santa Fe become stiffer towards the north of the same province ; they are then clay soils, sometimes even plastic clays, such as are met with also in a great part of the Chaco and of Formosa, regions covered with forests, particularly of " Quebracho colorado ".

Province of Buenos Aires. — The province of Buenos Aires, by far the most inhabited and the most highly cultivated of the whole Argentine, has an area of about 75 million acres, of which some 17 per cent., or 12 850 000 acres (1) are sown to wheat, oats, maize and flax, which are the chief crops of the country. Though the rest of the country is covered with natural grassland or put down to lucerne (2) and is kept chiefly as grazing land, it must be mentioned that there are many soils suitable for arable farming and that only a small part of the lands capable of yielding abundant crops are at present under the plough. Nevertheless every year the acreage of tilled and sown land increases to a remarkable extent ; but it must also be said that a good many soils which are too light and unsuitable to wheat are cultivated and this, together with unsufficient tillage, contributes in a large measure to lower the general average of yield.

The production of cereals is by no means uniformly distributed throughout the province ; it is on the contrary pretty much restricted to a belt bounded on the north and west by the provinces of Santa Fe and Cordoba, and on the south and south-west by a line slightly curved to the south, which, starting from a point somewhat lower than Buenos Aires, makes an angle of about 60° turned to the south with the meridian of the above town. In fact, out of the 9 400 000 acres under wheat, flax and oats in this province, 4 570 000 belong to this belt, which includes a total area of about 21 550 000 acres. Wheat alone accupies 2 565 000 acres, while oats has 885 000 and flax 1 194 000 acres ; if to these crops be added maize, which in the whole province is grown on 3 460 000 acres, of which 70 per cent. or 2 430 000 acres belong to this belt, the cultivated area of the belt amounts to 36 or 37 per cent. of its total acreage.

These figures show clearly that the province of Buenos Aires may be divided into two parts : one comprising the northern and north-western

(1) These figures are published by the Board of Statistics and of Rural Economics of the Ministry of Agriculture and correspond to the crops of 1911-12.

(2) There are about 5 million acres under lucerne in the whole province.

belts prevailingly devoted to field crops, of which we have above roughly sketched the boundaries, whilst the other more southern and much larger part, 52 585 000 acres in extent, is chiefly devoted to live-stock breeding. Of this area only 4 870 000 acres are sown to wheat, oats and flax, and 1 030 000 to maize, or a total of 5 900 000 acres, which amounts to only 11 per cent. of the whole acreage of the southern belt.

This distribution of agriculture in the province under discussion depends evidently to a great extent upon the nature and composition of the soil and subsoil; the best soils for crops are undoubtedly to be found in the northern part.

The alluvial beds in this belt are of great depth; the subsoil consists of yellowish or gray clay, mixed in variable proportions with silicious sand, not very permeable, which however weathers easily in contact with the air and rapidly gets loosened by tillage; it possesses the peculiar characteristic of permitting vertical cuttings to be made in it without any danger of caving in. The wells in this belt, and there are some which are quite ancient, have been excavated to depths which attain 80 feet and have never been lined with masonry. On this clay, which sometimes contains small quantities of gypsum, rests a black humiferous layer 24 to 32 inches deep. This layer is not homogeneous; the arable soil for a depth of 12 to 20 inches is in general less compact than the underlying stratum; the latter (or subsoil) is often very compact, and is in any case more clayey and consequently less permeable than the surface soil. The particles forming these two layers, which are the ones of special interest to the farmer, are very fine.

According to numerous analyses made, following Schloesing's method, at the Laboratory of the Ministry of Agriculture, and upon which this paper is based, samples from the upper layer to a depth of about 12 inches show a proportion of sand varying between 70 and 82 per cent. and of clay (silt and clay) between 12 and 25 per cent. They are somewhat heavy soils, which however can be ploughed without difficulty, even those which contain the most clay. They are for the most part sufficiently permeable; their colour when they are dry varies between gray and deep gray according to the quantity of humus present, which frequently amounts to 25 and 35 per cent. and often corrects the defects due to the excess of clay.

In general these soils are well provided with the elements of fertility; nitrogen, potash and phosphoric acid, though of the latter the content of these soils is frequently below 1 per thousand; they are all poor in lime, the maximum not exceeding 10 to 12 per thousand, of which about two-thirds is soluble in 2 per cent. nitric acid in the cold. In spite of their low lime content and the presence of large quantities of humus, these soils present in general an alkaline reaction to litmus paper; this is often due to the solubility of the very basic alkaline silicates that they contain. On the other hand, the presence of these alkaline salts in the soil contributes to render it more compact; it has then a marked tendency to pack under the action of the rain.

It is doubtless also partly due to the comparatively ready decomposition of these silicates that sodium bicarbonate is present in almost all the under-

ground waters and in many superficial ones (lagoons or "arroyos") in which the carbonate is also found.

Summing up, one may say that if it were a question of improving this soil, the addition of lime would be advisable as it would produce excellent effects. As for manures, the use of which is extremely limited in the country, the most advantageous would be phosphates, especially under the form of basic slag.

The subsoil in many cases lacks permeability, the result being that depressions without natural outlets get converted into more or less permanent sheets of water; this could easily be avoided by providing an outlet for the rainwater.

It is especially in the belt near the Rio de la Plata, to the south of the Federal capital, that these facts are observed, because the amount of clay in the soil and subsoil diminishes as one proceeds westwards. As a further illustration, we give in Table I some analyses of good soils of the northern and north-western belt.

Anyhow, in the greater part of this belt the soil presents no serious difficulty to tilling operations, and the permeability of the subsoil, somewhat defective in the most clayey parts, improves considerably on being suitably worked. These soils, on account of their physical characters and geographical position, will certainly be the first to be submitted to the intensive cultivation of cereals and flax. It must also be taken into account that they are entirely within the belt corresponding to 800 and 600 mm. (31.5 and 23.6 inches) of yearly rainfall.

At present the average yield of wheat is about 12 bushels (of 60 lbs.) per acre in the north of this belt and reaches 15 bu. in the rest; these yields, the former especially, are not high, but it must be remembered that we are dealing here with extensive cultivation, upon which is bestowed the least possible amount of labour and no manure. In the most northern part of this belt about one-fifth of the acreage under wheat attains an average yield of 22 bu. per acre; whilst in the most southern part this yield is given by about one-third of the land under wheat, and on one-eighth of the area it even reaches 30 bushels.

Besides cereals, this belt is very suitable to the production of fruit, especially dessert grapes, and of vegetables, for which for a fairly great distance round Buenos Aires and other centres of population there would be no lack of manure, which is only now beginning to be used and that to a very limited extent; but in these somewhat compact soils, poor in lime, abundant manuring would not be advantageous unless a fairly abundant liming were previously resorted to. The rest of these lands form good natural grass devoted to grazing. Notwithstanding their relative poverty in lime, lucerne gives excellent results; it is really the only forage plant that is grown in the country, succeeding in almost every locality in which the rains or the natural moisture of the soil are sufficient.

To the south of the line, which for lack of natural landmarks we call the limits of the northern belt, the rest of the province of Buenos Aires may again be divided into two parts: a central one which includes about 20 558 800

TABLE I. — *Analyses of Soils. Province of Buenos Aires. North and North-west belt.*

	I		II		III		IV			V		VI	
	S Brown	S' Yellowish brown	S Brown	S' Yellowish brown	S Brown	S' Yellowish brown	S Brown	S' Yellowish brown	S'' Yellow	S Dark gray	S' Yellowish gray	S Dark gray	S' Yellowish gray
Fine gravel. . . . . %	0	0	0	0	0	0	0	0	0	0	0	0	0
Coarse sand . . . . . »	17.10	9.50	2.66	2.07	42.10	38.10	13.20	2.80	6.00	25.20	26.70	55.51	63.27
Fine sand	55.20	56.70	77.56	70.98	41.10	40.20	74.00	51.20	61.20	58.10	48.40	30.10	24.90
Total sand . . . »	72.30	66.20	80.22	73.05	83.20	78.30	87.20	54.00	67.20	83.30	75.10	85.61	88.17
Clay . . . . . »	24.60	31.70	17.30	24.40	12.60	18.60	10.20	41.80	29.70	12.40	23.30	7.95	9.31
Humus . . . . . »	0.80	0.20	1.40	0.80	3.00	0.80	0.90	0.70	0.20	3.00	0.50	2.20	0.50
Organic detritus and soluble matter »	2.30	1.90	1.08	1.75	1.20	2.30	1.70	3.50	2.90	0.40	0.60	4.25	2.02
Nitrogen . . . . . ‰	1.48	0.76	3.12	1.34	2.66	1.06	1.81	1.25	0.62	2.51	0.99	1.94	0.80
Total lime (CaO) . . . . . »	5.80	5.46	7.11	5.46	9.74	8.23	4.10	4.26	11.65	8.20	6.73	7.76	6.41
Soluble lime . . . . . »	3.98	3.92	5.32	3.86	5.43	3.75	1.96	2.41	7.50	2.86	3.58	1.75	2.32
Potash (K_2O) . . . . . »	7.82	8.19	4.96	5.64	4.79	5.18	5.83	11.34	11.54	5.87	6.62	3.82	3.40
Phosphoric acid . . . . . »	1.29	0.81	1.71	0.88	1.32	0.75	0.88	1.12	1.60	1.50	0.82	1.13	0.50

S = Soil — S' = Subsoil — S'' = Second subsoil.

acres, of which 3 169 900 acres or 15.4 per cent. are under cereals: wheat 2 005 600 acres, oats 649 600, and maize 513 750 acres; hardly any flax is grown.

The characters of the arable lands of this central region resemble those of the neighbouring belt which we have described, but they become gradually lighter, especially towards the south and south-west. Some analyses giving the composition of these soils and subsoils, as well as their content of fertilizing elements, are given in Table II.

Many of these soils may be classed as good loams, the others as light, that is they are very easy to till and very permeable. The average yield of wheat is very low, rarely above 7.7 bushels (of 60 lbs.) per acre. These soils are nevertheless well provided with the elements of fertility excepting phopshoric acid, the amount of which is frequently inferior to 0.80 per thousand. They are also poor in lime, rarely containing more than 10 per thousand. The arable soil rests on a subsoil much less compact than in the north-western belt, and which often differs but little from the soil and is consequently very permeable. Nevertheless, if one examines the map of this region, as well as that of the sea-coast of which mention will be made further on, one is struck by the number of more or less permanent lagoons scattered over the surface. Almost all of these lagoons are due to the presence of an interrupted bed, without any appearance of stratification, of a kind of pan, called "tosca" in the country; it is an impermeable concretion, more or less ferruginous and containing lime, generally thin, but sometimes attaining a thickness of 16 feet. It is situated at varying depths and frequently in low-lying parts crops out at the surface. This formation (1) is rather widely distributed in the country; it exists also in the northern belt, but often at a certain depth, forming in the gray and yellow clays discontinuous lenticular areas upon which the water accumulates, forming the first sheet of underground water. The belts in which "tosca" is at a slight depth are only adapted to natural grassland; in the other parts lucerne grows very well.

Though live-stock breeding will prevail in this region, there are many soils in it suitable for growing cereals, as well as potatoes, which do admirably in the lighter parts.

In the rest of the province, that is the part along the Atlantic, whose area may be estimated at 32 million acres, only about 2 ½ million acres are sown to cereals. This is the region of sandy soils, with but slight cohesion, some of them shifting sands, as towards Bahia Blanca.

These lands are mostly covered with natural grassland and lucerne fields; the latter are found wherever the depth of the soil and of the subsoil allow it, in the higher parts of the undulations, where the "tosca" is at a sufficient depth not to interfere with the root development of the plants.

Such are in broad lines, the principal characters of the soils and subsoils encountered in the province of Buenos Aires. But it will be easily

(1) It constitutes one of the characteristics of the Pampean system.

TABLE II. — *Analyses of soils. Province of Buenos Aires. South-west and south region.*

	I		II		III		IV		V	
	S Grayish black	S' Gray	S Dark brown	S' Yellow	S Light brown	S' Yellowish brown	S Grayish brown	S' Yellowish brown	S Black	S' Yellowish brown
Fine gravel . . . . . %	0	0	0	0	0	0	0	0	0	0
Coarse sand . . . . . »	23.70	34.20	49.80	64.40	78.80	83.00	26.90	21.90	10.80	14.20
Fine sand . . . . . »	61.44	50.84	39.60	29.00	16.30	12.10	60.70	59.70	67.17	61.48
Total sand . . . %	85.14	85.04	89.40	93.40	95.20	95.10	87.60	81.60	77.97	75.68
Clay. . . . . %	9.90	13.50	4.30	6.00	3.60	4.10	10.60	16.00	19.00	22.90
Humus . . . . . »	3.20	0.60	3.00	0.10	0.50	0.20	1.60	0.60	2.60	0.60
Organic detritus and soluble matter . .	1.70	0.86	3.30	0.50	0.70	0.60	0.20	1.80	0.43	0.82
Nitrogen . . . . . ‰	3.13	0.75	3.32	0.50	0.73	0.56	2.59	1.12	2.86	1.08
Total lime (CaO) . . . . . »	4.76	3.84	7.81	5.81	6.83	6.83	6.94	7.00	11.79	15.82
Soluble lime	4.69	2.45	3.98	1.12	1.96	1.74	3.36	3.36	6.65	10.15
Potash (K_2O)	4.22	2.34	4.22	4.08	3.02	3.04	4.08	5.03	5.44	6.77
Phosphoric acid. . . . . »	1.44	0.55	1.13	0.32	0.95	0.82	0.77	0.46	1.46	1.10

S = Soil. — S' = Sub-soil.

understood that the limits of the areas covered by these various types, which we have just described, cannot be given otherwise than approximately. In this immense plain the changes in the characters of the soil are far from being sharply distinguished from each other like soils resting on the geological formations from which they are derived ; we will add that there are no areas of any importance which contain only one and the same type of soil. As we have already observed at the beginning of this paper these are alluvial soils, the mineralogical constituents of which have not, as far as we know, been investigated, but which seem to present very slight differences from one point to another, but which from an agricultural point of view differ in their greater or lesser content of clay and also of humus, that is to say chiefly in their degree of cohesion and of permeability, which change gradually from one point to another.

Province of Santa Fé. — It is needless to say that the boundaries of the provinces do not constitute limits to the types of soil ; these are almost always the same in the borders of neighbouring provinces; thus in the south of the province of Santa Fé on the northern boundaries of the province of Buenos Aires, the arable lands are similar to those of the northern belt of the latter. These lands in the province of Santa Fé form a total of 12 972 500 acres, of which about 53 per cent. are sown to wheat, oats, maize and flax. The total area of this province is estimated at 32 450 000 acres, so that that under cereals and flax is about 7 336 000 acres, of which 6 847 000 acres, or 93 per cent., belong to the southern belt.

Here also, on a considerable depth of alluvial soil of the same nature as those already described, the same humus layer, sometimes 3ft. deep, is found ; with it occurs a somewhat heavier superficial layer on a more compact subsoil containing more clay ; these characters are still more marked along the Rio Parana, and diminish towards the west and south-west.

Like the north and west of the province of Buenos Aires, the southern part of that of Santa Fé is one of the oldest under cultivation ; as an example of the composition of its soil and subsoil some analyses are given in Table III.

The analogy between these soils and those of the neighbouring belt is evident ; they are likewise generally well provided with humus, nitrogen and potash, with perhaps a somewhat lower content of phosphoric acid, but they are all poor in lime.

In general, under this arable layer, about one foot or more deep another blackish layer is found : this contains more clay and is often but little permeable, but becomes more so on going towards the north. Nevertheless, in the northern part of this province there is also a fairly important area in which the soil, of average or slightly heavy nature and sometimes even very light, rests on a very clayey and almost impermeable subsoil, containing 38 to 45 per cent. of clay (silt plus clay).

In the most northerly part of this same province, bordering on the Chaco, are found only blackish or gray, more or less deeply coloured, very plastic clays, which crack on drying and become very hard ; these lands cannot be used except for grazing. These two belts represent about 19 478 000

TABLE III. — *Analyses of soil. Province of Santa Fé.*

	I		II		III		IV		V	
	S Reddish brown	S' Reddish brown	S Dark gray	S' Yellowish gray	S Yellowish grany	S' Yellow	S Gray	S' Yellowish brown	S. Gray	S' Grey blaek
Fine gravel . . . . . %	0	0	0	0	0	0	0	0	0	0
Coarse sand . . . . . »	18.50	14.20	10.90	13.00	4.60	2.30	2.20	1.30	3.40	2.50
Fine sand . . . . . »	59.00	42.40	69.50	57.40	66.60	56.70	82.53	61.14	47.84	48.86
Total sand	77.50	56.60	80.40	70.40	71.20	59.00	84.73	62.44	51.24	51.36
Clay . . . . . »	20.00	41.30	17.00	27.00	25.90	38.70	12.50	35.40	47.00	46.40
Humus . . . . . »	1.50	0.10	1.20	0.70	0.90	0.30	0.50	0.20	1.10	0.50
Organic detritus and soluble matter . . »	1.00	2.00	1.40	1.90	2.00	2.00	2.27	1.96	0.66	1.74
Nitrogen . . . . . ‰	1.60	1.15	2.93	1.37	1.30	0.74	0.98	0.69	2.16	0.49
Total lime (Ca O) . . . . . »	5.40	6 97	8.85	7.00	6.92	8.40	3.53	5.91	4.84	3.64
Soluble lime . . . . . »	3.47	4.98	5.54	3.86	3.86	5.21	2.38	3.50	3.64	2.59
Potash (K_2O) . . . . . »	6.20	7.33	7.54	7.22	6.21	6.93	6.53	10.06	9.05	9.54
Phosphoric acid . . . . . »	0.94	0.94	2.45	1.38	1.21	1.29	0.51	0.78	1.00	0.77

Analyses Nos. I, II, III: Southern part; No. IV: Central part; No. V: Northern part. — *S* = Soil. *S'* = Subsoil.

acres, of which about half belongs to the intermediate belt which is cultivable at many points.

The provinces of Buenos Aires and Santa Fé are especially favoured on the one hand by their geographical position in proximity to the Parana and La Plata rivers, which border their greatest length, and on the other by their climatic conditions, which ensure them an abundance of rain equally distributed throughout the whole year, so that they do not need irrigation ; there exists here an unbroken area of nearly 34 ½ million acres of very good soils suitable for most crops, and which, in order to yield good harvests and satisfactory economic results, do not in general require for the moment anything beyond tillage suitable to the nature of the soil and subsoil.

Of course, as has been stated, there are also lands exhausted by an exclusive and continuous production of wheat and flax during many years (20 or 25 years and even more) without any manuring; but a more systematic farming, and the use of green manuring in default of other manure, would soon change this state of things, especially if liming were resorted to, using for the purpose the deposits of limestone which are found in large quantities near the Rio Parana on the shore opposite Santa Fé, near the city of this name, without mentioning the important beds of small mollusc shells which have accumulated chiefly along the banks of the Rio de la Plata.

Anyhow, these exhausted lands occupy only a relatively limited area when compared with that which remains to be or has only recently been brought under the plough.

To this vast extent of 34 ½ million acres must be added another and not less interesting one which forms the central part of the province of Buenos Aires and comprises 20 560 000 acres. It also includes some good soils, which, though generally lighter than those of the north-western and northern belts, are capable of giving good crops of cereals. This is a region of mixed farming, that is including live-stock breeding and dairying, whilst further south, along the coast up to Bahia Blanca, breeding will always prevail.

The intermediate belt of the province of Santa Fé is at present but little cultivated ; it could, however, be profitably cropped in many places where the soil is deep enough and the subsoil less impermeable, if it were not for the almost absolute lack of superficial and subterranean water suitable for human and animal consumption (the water found even at great depths being brackish). This is general throughout this region up to the Chaco (Chaco Santafecino) and in the neighbouring one, both to the south-west in the province of Santiago del Estero (Chaco Santiagueño) and to the north-west in that of Salta (Chaco Salteño).

The Study of Agricultural Geology in Italy

by

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The object of this paper is to give a brief account of what has been done in Italy in the geological investigation of the soil, to form an introduction to the bibliography which follows.

In this paper and in the bibliography, agricultural geology is taken only in connection with the study of the soil; thus everything concerning the water supply, and especially the underground water, is excluded. This subject is of the greatest importance for agriculture, and forms a part of a distinct chapter of applied geology. It may be treated separately.

With this attempt at grouping together everything that has been done in Italy in the matter of geological research in connection with agriculture, I do not claim to have drawn up a complete survey and bibliography. Thus, for instance, I have deliberately excluded those works of a too markedly chemical character (1), all the general geological descriptions in which the agricultural conditions of the regions described are considered, but too incidently, and lastly all strictly phyto-geographical works (2).

Italy had given some fine examples of the application of geology to agriculture in Gemellaro's works (Bibl. 46), which date back to 1825, if indeed the classical works of Filippo Re, though prevailingly agricultural, be not taken as the earliest, for Re already in 1809 demonstrated the importance of the study of the soil.

The above were followed, still early in the nineteenth century, by the works of Giuli (Bibl. 51), Cuppari (Bibl. 19-22), and Savi (Bibl. 84,85). Then for a long time no geologist took interest in agriculture, nor were there agriculturists sufficiently versed in geology to apply this science with advantage to the study of the soil, which during this period had remained the undisputed domain of agricultural chemists, who enriched it by important contributions.

About 1890 the study of agricultural geology began to be taken up again in Italy, thanks to the professors of agriculture and to the agricultural

(1) Such as the following works:

Sestini F.: Il terreno agrario. — *Enciclopedia agraria italiana.* Turin, 1899.

Sestini, F.: Materiale per una carta chimico-agronomica dei terreni della pianura pisana, ecc. — *Atti Soc. Tosc. Sc. Nat.*. Pisa, 1903.

(2) Such as the fine general part of L. M. Gortani's work: *Flora della Carnia.* Udine, 1904.

institutions and associations, among which the following deserve especial mention : the Association of Italian Agriculturists, the Royal Academy of the Georgofili, the Agricultural Society of Friuli, and the Antiphylloxera Association of Brescia. From this period a fairly abundant and very important literature on the subject begins to flourish.

As may be seen from the annexed bibliography, the Italian works on agrogeology may be divided into various groups.

For educational purposes some treatises were and still are used. Besides the older works (Bibl. 18, 44), in 1898 Parona's book (Bibl. 69) appeared ; in this the general geological part, always treated with special reference to agriculture, is followed by interesting information on the soils of the several provinces of Italy, some of it compiled by the writer himself, the rest being due to his collaborators (Bibl. 5,38). This work has remained up to the present the only source from which a general idea of the soils of the several regions of Italy could be drawn.

A second and more recent compendium (Bibl. 114) is of a different type. being a guide to the course of agricultural geology held in the Royal College of Perugia. Besides treating of the soil, it treats also of the waters, because in the opinion of the writer pedology and hydrology form an intimately connected whole and make up the real agricultural geology.

The good handbook (Bibl. 116) of Vallardi's agricultural library devotes itself more to the soil (1).

The monographs on the agricultural geology of individual regions are numerous. Among these, that on the Montello (2) is excellent (Bibl. 91) ; very praiseworthy also are those which describe the soils of Friuli (Bibl. 35, 41, 42, 101 and 102), those of Brescia (Bibl. 16, 17), of the territory of Grotte di Castro (nr. Viterbo, prov. Rome) (Bibl. 66) of Rosignano marittimo (prov. Pisa) (Bibl, 110), of Casalina (prov. Perugia) (Bibl. 12).

Nor are studies on our colonies wanting. One on the soil of Benadir appeared this year (3), while from the same author a work appeared some time ago on some soils of Eritrea. The soils of Lybia have already been the subject of some studies (Bibl. 58, 113, 119, 120), among which the principal is that on the soils of Tripoli due to a commission appointed by the Government, which confirmed what the writer had already demonstrated in 1903 (Bibl. 113), namely that the so-called desert round the oasis of Tripoli consists of the same types of soil which form the oasis itself and cannot therefore be considered as a real desert, but must be looked upon as cultivable land.

Geology has been called upon also in the land registration work. Already the old land registration contained brief notices on the nature of

(1) Completed from the hydrological point of view by the following work: PRINCIPI, P. *Idrologia agraria*. Milan, 1912.

(2) A wooded district near Montebelluno, prov. Treviso. (*Ed.*).

(3) PRINCIPI, P. Osservazioni sui terreni agrari della Somalia italiana. — *Giorn. Geologia italiana*. Parma, 1913.

the Italian soils. On the reorganization of the office of agricultural statistics by Ghino Valenti, it was ordered that every agricultural region in the land register should be accompanied by summaries of the geological formations which make up the region. Surveys accompanied by such notices have already appeared for Latium, the Marches and Umbria (Bibl. 57), while those of Lombardy, Tuscany and Piedmont are in the press.

Geology has also been used as a base in the valuation for land registration, but works of this kind are not numerous, being limited to one on the province of Verona (Bibl. 64) and one on that of Cuneo (Bibl. 59).

A very important subject, that of agrogeological maps, has recently been much discussed and treated in Italy. Stoppani and Taramelli also called the attention of the Government to the matter, and in 1880 proposed a bill for the preparation of these maps. In 1896 the Society of Italian Agriculturists took up the question with energy. The Geological Bureau, however, being occupied with the surveys for the geological map of Italy, could not undertake this new work, and so the matter of the State agrogeological maps was allowed to drop. There were, it is true, several praiseworthy attempts on the part of Associations (Bibl. 15-17) and of private persons (Bibl. 3, 6, 12, 13, 35, 41, 42, 66, 91-93, 101, 102, 104, 105, 108, 110), who draw up valuable maps on their own account. But, as could have been foreseen, these maps were wanting in the uniformity which could only be given by an official scientific commission, and they turned out very unequal owing to the different views of the various authors or to the objects for which they were made. But this is no great harm, because when the organization of the agrogeological map, which becomes a necessity, is undertaken, several types of maps will have already been tried and among these a judicious choice can be made.

After all, the general criteria for drawing up these maps have been amply discussed (Bibl. 1, 71, 78, 79, 90, 99, 111, 112, 121, 122, 124), so that it will be fairly easy to unify the manner of setting forth the data to be shown by the maps.

Without actually drawing up the maps, several writers have contributed important descriptions of the agrogeological conditions of the various regions of Italy (Bibl. 4, 8, 24-26, 36, 37, 39, 46, 49, 50, 53, 60, 62, 63, 68, 72, 73, 82, 87, 89, 94-98). Nor have important purely scientific researches (Bibl. 27, 31, 75) on interesting questions on the soil and its behaviour been wanting.

In conclusion, it may be said that there is no branch of agricultural geology which has not been more or less extensively treated of in Italy.

The renewed interest in agrogeological study in Italy coincided with the increased importance of the teaching of agricultural geology. It had been considered as a subject of secondary importance in the various Agricultural Colleges and it was taught by the same professors as mineralogy. The College of Perugia was the first to establish an independent course of agricultural geology and mineralogy, which soon became geology and lithology and which is now simply agricultural geology. The example of Perugia was more or less faithfully followed by the other Colleges,

and the new Forestry Institute of Florence has a chair of geology applied to forestry. On this subject also several works have appeared (Bibl. 10, 11, 29, 33, 52, 85, 123).

The new chair and those of the Agricultural Colleges are occupied by capable scientists, young and promising men, so that their labours, completed by that of the Government and of the local bodies, warrant us in trusting that in the field of agricultural and forest geology also Italy is in a fair way to occupy the position which is due to her and which it is her duty to occupy soon.

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The Cultivation of Medicinal Plants in Hungary

by

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The climate and soil of Hungary offer very favourable conditions for the cultivation of medicinal plants, which has been practised from remote periods, without however attaining the social importance that it has at the present day. During the course of last century some dye plants played a very important part, as, for instance, madder (*Rubia tinctorum*), saffron (*Crocus sativus*), woad (*Isatis tinctoria*), dye-hollyhock, etc.; then

hen chemical products took the place of these plants, this branch of arming lost its primitive importance and the cultivation of medicinal lants was also neglected.

In 1904 the writer proposed the more systematic utilization in Hungary f the abundant wild drug plants, the better cultivation of the most valuble among them, and the institution for this object of an Experiment Staion. The same year the Ministry of Agriculture approved of this initiative nd founded the Medicinal Plant Experiment Station at the Agricultural cademy at Kolozsvár (Klausenburg).

The Station studies the systematic cultivation of drug plants, deterines their value, and studies all the questions concerning them. According o the results obtained, it promotes the cultivation of drug plants and assists eginners both in the cultivation of the plants and in disposing of them. hanks to this service, every day the number of growers of such plants inreases. Among the pioncers of the movement the curé Joseph Agnelli f Csári is especially worthy of mention as a grower and selector. Certain arieties produced by him, such as the *Agnelliana* varieties of *Mentha rispa* and *Mentha piperita*, are much esteemed, even abroad. On the other and Dr. Eugene Szkicsák, chemist at Privigye, has organized the "Carathia" Company for the cultivation and preparation of medicinal plants. ome large landowners are also beginning to turn their attention to the aising of certain drug plants, such as coriander, the product of which is old abroad for the extraction of the essential oil. Lately also the growing f drug plants had been introduced into prisons, reformatories and deaf-and-umb schools by the directors of such institutions, thus affording useful ork to otherwise idle hands.

The Experiment Station has for the last eight years organized a yearly ourse for schoolmasters and the regional clergy, who in their turn spread mong the people the knowledge they have acquired. Besides, the Ministry of griculture arranged courses in 1912 at Zsolna for the schoolmasters of Northern Hungary.

Among the numerous drug plants of Hungary the following are especially to be mentioned:

Curled mint (*Mentha crispa*).— Of late years the curled mint of Hungary as been in growing demand on the markets of the world, partly on acount of its superior quality and partly owing to the increasing consumpon of the essentiai oil of mint. Analyses made at the Experiment Station have emonstrated that the essential oil of Hungarian curled mint is characerized by its high laevocarvone content: 62 to 71 per cent., against 56 er cent. in the oil of American mint, 35 to 56 per cent. in the German oil, nd 5 to 10 per cent. in the Russian product.

Hungarian curled mint is especially sought for by the large German firms, ho export quantities of it to America. It is expected that this exportaon will soon become very considerable. As for its yield, at least 11 cwt. er acre are obtained, and under favourable conditions 18 to 19 cwt. per acre dry crop, which may be valued with the stalks at £1 1*s* 2*d* to £2 0*s* 4*d* er cwt. The gross yield may thus range from £12 to £40 per acre.

Peppermint (*Mentha piperita*) is cultivated in several regions of Hungary on greater extents of land. The dried leaves (*folia menthae piperitae*) are used for infusions, while menthol and the essential oil of peppermint (*oleum menthae piperitae*) are still more used. The value of this plant depends upon its menthol content. In this respect Hungarian peppermint is superior to American, for while the former contains 42.88 to 55.9 per cent. of free menthol and 55.38 to 65.19 per cent. of total menthol, the American peppermint contains 40 to 45 per cent. of the former and 59.6 per cent. of the latter.

Peppermint is cultivated in the Great Hungarian Plain (Alföld), as well as in the north of Hungary and in Transylvania. It is exported in great quantities to Austria and Germany; in 1912, however, the trade in this drug was not so brisk as in curled mint. Peppermint yields from 7 to 10 cwt of dry herb per acre worth about £1.14*s* to £2.2*s* per cwt., so that the gross returns from an acre range from £12 to £21.

Balm (*Melissa officinalis*) is grown in some dry localities of Hungary. At the Station the cultivation of this plant has succeeded admirably and the farmers of Upper Hungary and of the Alföld have obtained good results. On the whole it may be said that Hungary produces a fine and very aromatic balm, the climatic conditions of our country suiting it very well. It is not consumed to the same extent as the mints. According to experiments made at the Station, a revenue of about £23 per acre, after deduction of the cost of labour, may be expected from it.

Sage (*Salvia officinalis*) grows in similar conditions and is cultivated in gardens. It is a native of the South of Europe, where it grows wild and whence great quantities are sent to the markets of the world. Though it is exported from Italy and Dalmatia at a very moderate price, its cultivation is profitable, as the cultivated plant is more esteemed.

Clary (*Salvia Sclaria*) is also grown in Hungary. Its flowers and leaves are in great demand for their strong smell and aromatic flavour and are used especially for doctoring wines. Most of it goes to Germany.

Sweet marjoram (*Origanum Majorana*) is being increasingly grown in Hungary. It is sent to the Austrian, German and French markets. In Paris the celebrated marjoram of Provence has been compared with the Hungarian product and the latter has been found the finest and most aromatic. It has thus a great future before it in Hungary, especially on the right bank of the Danube and on the Alföld, where it is most cultivated. Marjoram can yield a profit of £12 per acre.

Hyssop (*Hyssopus officinalis*) and rue (*Ruta graveoleus*) thrive well in the dry parts of Hungary, especially on the Alföld, as they are very drought resistant. According to the experiments carried out at the Station, they can yield a yearly income of £11 5*s* to £22 10*s* per acre; nevertheless these two plants occupy a very subordinate position in the trade. Most of the exportation is to Austria and Germany.

Several large estates in Hungary grow coriander (*Coriandrum sativum*). Recently, Hungarian coriander has become an important factor in the trade, in which formerly Thuringian and Moravian corianders were predominant.

Sweet fennel (*Foeniculum officinale*). — In the trade Roumanian fennel is considered of superior quality and is much esteemed. It is immediately followed by the Transylvanian fennel. Its oil answers to the demands of foreign pharmacopœias.

Angelica (*Archangelia officinalis*) prefers districts with frequent rainfall; thus the experiments conducted at Kolozsvár gave very satisfactory results. It has also been cultivated in several districts of Upper Hungary.

Caraway (*Carum Carvi*) is cultivated in Hungary by small and large farmers, but it cannot compete with Dutch caraway. Anise (*Pimpinella Anisum*) is not yet cultivated in Hungary on a large scale, though its essential oil answers perfectly to foreign requirements.

Among the Hungarian medicinal plants which do not contain volatile oils, marsh mallow (*Althaea officinalis*) deserves to be mentioned first. It grows especially along the Tisza and in the fields along the large rivers, particularly on salt lands. Along the Tisza the wild plant is gathered by the people. There are, however, localities in which it is cultivated; the first year the roots are too small, so that only the leaves and flowers are gathered; in the second year it gives a crop of roots. In order to utilize the soil better, beets are planted between the rows of marsh mallows. This plant is in demand on the markets of the world; it is exported chiefly to Germany and to Austria, as either crude or prepared roots (cut into cubes).

Hollyhock (*Althaea rosea* var. *nigra*) is cultivated for its black flowers; it is used in medicine and as a dye-stuff. At present it does not enjoy the reputation that it formerly had; nevertheless it is still cultivated in some parts of Hungary.

Blessed thistle (*Cnicus benedictus*) is much esteemed in therapeutics under the name *herba cardui benedicti*. It is much used in the manufacture of the liqueur called Bénédictine. Its cultivation is very profitable; thus Hungary may hope to export great quantities of it in future. According to experiments made with this plant at the Station, it is capable of yielding a profit of £13 17*s* per acre.

Sweet flag (*Acorus Calamus*) grows in swampy places in Hungary. From its rhizomes and roots the drug known as *rhizoma calami* is prepared. In some localities it is planted in swampy grounds.

Marigold (*Calendula officinalis*) and mullein (*Verbascum phlomoides*) have been cultivated in Hungary for some years past for their flowers. The flowers of marigold (*flores calendulae*) are used for the adulteration of saffron and in the preparation of incense. In France marigolds are used on a great scale. The flowers of mullein (*flores verbasci*) are among the most precious and esteemed drugs. For this reason not only are the wild plants, which grow plentifully on the sandy soils of Hungary, gathered, but recently the plant has been cultivated. The cultivation of *Verbascum*, a biennial plant which flowers only in the second year, is to be recommended to small farmers who have large families in which the children could attend to the daily gathering of the flowers and to their careful drying.

Whilst most of these medicinal plants are grown in gardens, the cultivation in Hungary of the two varieties of mustard is carried out on

a large scale. The growing of white mustard (*Sinapis alba*) succeeds better than that of black mustard (*Brassica nigra*) and is consequently more practised in Hungary. Besides its use in medicine it is grown as green food.

I may mention also the following medicinal plants which are grown in Hungary on a small scale: *Chenopodium ambrosioides, Inula Helenium, Ocymum Basilicum, Artemisia Dracunculus, Artemisia Absinthium, Thymus vulgaris, Datura Stramonium, Atropa Belladonna, Anthemis nobilis, Conium maculatum, Levisticum officinale, Pyrethrum cinerariaefolium, Rheum, Tanacetum vulgare.*

The Profitableness of Present-day Sheep Keeping in Germany, especially in comparison with Cattle and Pig Keeping

by

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The question of the profitableness of present-day sheep keeping has arisen without doubt from the unprecedented decrease in the flocks on the one hand and the increase in the numbers of head of cattle and especially of pigs on the other.

The live stock census in Germany shows the following returns:

Year	Numbers of Sheep	Pigs	Cattle
1873	24 999 406	7 124 088	15 776 702
(1907)	(7 703 710)	(22 146 532)	(20 630 544)
1912	5 787 848	21 885 073	20 158 738
	Decrease: 19 211 558.	Increase: 14 760 985.	Increase: 4 382 036.

N. B. — The data for 1912 are from provisional communications.

It must also be considered that these figures are the result of the grouping together of animals of various ages and without account being taken of their weight, and that in the census, which is always made in December, the calves, lambs and pigs born and slaughtered within the year are not included. In spite of this the figures are very eloquent as to the movement of the stocks within a period of close upon 40 years.

It appears at first sight that these changes are due to the recognition of the fact that sheep keeping is unprofitable compared with pig and milk-stock keeping.

In reality the question is not so simple. Sheep keeping has had to contend with hard times. The prices of wool have steadily and considerably fallen (though they have risen again from 1*s* per lb. in 1894 to 1*s* 6*d*

per *lb.* in 1911), and the possibility of selling fat sheep and lambs in France and England, which for a long time had played an important part, has been lost. The income from many flocks has thus considerably diminished, but the effect of these causes has been much overrated. Since 1894 the price of mutton has again risen, from about £2 9*s* 9*d* per cwt. carcase weight to £3 15*s* 3*d*, and the prospects are that the prices will keep at this level or even rise, for with the increasing prosperity of the population the consumption of mutton, as can already be seen, increases. There are many other reasons for the decrease in the numbers of sheep in the country: the rapid disappearance of fallows and of commons, the increased cultivation of field crops, etc.

Unfortunately it must be said that the sweeping elimination of sheep, trough certainly sometimes the result of a careful consideration of all the circumstances, has in most cases been decided upon without that careful examination which in trade and in the industries is never neglected before abandoning some particular branch.

A clear vision of the profitableness of a branch of farming can only be obtained by careful figuring, and as this is difficult in farming, and many different opinions struggle for the mastery, one doctrine which evades all these difficulties has obtained wide diffusion; it asserts that farming is an organism from which no part can be separated or eliminated without injuring the whole; therefore each separate account is not only unnecessary but injurious and misleading.

Thanks to our marvellous progress in scientific knowledge and technical improvements, some unexpected increases of gross returns have been granted us. Connected with the endeavour to supply the people with food raised in the country itself, the increase of intensity in farming has become an axiom, unfortunately without due consideration of the limits of suitableness set for any given case.

It seems almost unnecessary to emphasize the fact that the increase of intensity is limited by the conditions obtaining, which cannot be overstepped without causing losses; yet it is just this consideration which it is so difficult to get people to recognize. The increased employment of capital and labour depends upon the will of the farmer, who shapes his course according to theoretical discussions and the results of experiments, but the effects hoped for may be limited or fail altogether owing to many adverse causes in the nature of the soil and the climate, or owing to the conditions of the markets.

How is it possible to judge these facts without the most complete control by means of accounts?

A mistake in the fields is punished once in the year with the unsuccessful crops, while mistakes in stock rearing, which owing to their smallness for each individual easily pass unnoticed, get multiplied by the number of head and by the 365 days of the year and can thus grow to such a magnitude that not rarely the most brilliant results of the field are completely swallowed up by the losses on the stock, and the farmer finds himself confronted with a negative total result.

It would be beyond the limits of this paper to enter into the question of the difficulties of agricultural accounts. They lie principally in the reciprocal relations between the fields and the stables. A theoretically perfect solution of these difficulties will perhaps never be found, but the practical way of evading them has long been pointed out; unfortunately it is discussed by many and followed by too few, because it is tedious, requires much care and causes expenses.

According to the above, it appears that it is impossible to answer the questions that have been raised, owing to the insufficiency of the material collected. I shall, however, endeavour to give a relatively practical solution, but I must first premise the following:

The most recent work of von Telschow on sheep breeding and rearing deals also with their profitableess and discusses it with the aid of an example of sheep keeping in which, according to his opinion, all the widely spread errors which he deplores and which are credited with being the cause of lack of success, have been avoided. But as in his account he has failed to consider on the one hand the hay, straw and pasture used and on the other the manure produced in the sheds, his work is only a calculation without any comtrolling and correcting connection with the rest of the farm. It is evident that precisely this want of control (all the more so that in this instance the capital invested in sheep is said to yield 22 ½ per cent. interest) is calculated to cause mistrust, dealing as it does with a branch of industry which is considered generally as unprofitable. The example misses in this manner the object for which it was intended.

Notwithstanding the difficulties attendant on the solution of the problem, I shall endeavour to answer the question which has been put, feeling justified in so doing for the following reasons: I have for the last 40 years, with the cooperation of the most eminent and intelligent farmers, striven to investigate with scientific rigour the profitableness of farming and, above all things, to ascertain the causes of the success or lack of success of the separate parts of the farm which go to make up the whole result. In this work I have found that the most progressive farmers have taken an ever increasing interest, and, in spite of the criticism of the majority of their colleagues who held opposite opinions, have in time recognised the error of too general theories, especially that which considers a farm as an indivisible organism (Organismus theorie).

In my research on the income of the several branches of a farm I have always sharply separated the questions concerning live-stock keeping from those dealing with the field crops, and each branch of farming has been most exhaustively examined, so that a clear idea can be had of each of them. This method enables me to treat separately any part of the work of farming.

Thus already 27 years ago I examined, with the help of my farming accounts and calculations, the conditions which were considered causes of the extraordinary decrease of sheep keeping, which had already set in. The result of this work proved, among other things, that the sale of wool and mutton had in reality nothing like as great an influence as was generally

attributed to them on the decrease in the numbers of sheep; it proved further that properly conducted sheep keeping was not only profitable, but could under suitable conditions surpass the profitableness of milch-cows and pigs.

The interest for these questions has in the meantime much increased, and two years ago I considered it opportune to attack again the prejudice against sheep keeping which had not yet been in any way shaken. I had the advantage of having much more available material, wich has been collected for the last 20 or 30 years always on the same principles, and has been proved to be correct by the other results of the farm.

I was thus able to establish that the general results of the earlier investigations are generally confirmed by the present ones and that undoubtedly for numerous farms keeping sheep is even now a branch of farming which deserves consideration and that under many conditions it yields more profit than cow or pig keeping, or at least as much. Nevertheless there are many farmers who, in spite of the instructive results of their book-keeping, have less faith in this than in universally accepted opinion, or who from a general point of view prefer unlimited increase of intensity of farming in the hope of realizing in the future extraordinary benefits.

The question now arises whether the results of these investigations, which, however carefully made, still represent only limited sources compared with the totality, are sufficient justification for conclusions baing drawn as to general conditions. I believe they are, as I am convinced of the correctness of the methods followed and of their results.

I shall give my results here in figures in the hope of supplying some useful data to farmers.

The following is a case of sheep breeding during a period of 15 years, from 1896-97 to 1910-11, which for want of space is divided into three periods of 5 years each. During the first period 350 sheep gave a loss per head per year of 4*s* 9*d* ; the next five years showed a profit of 1*s* 10*d*, and the last five a profit of 7*s* 7*d* per head per year, or an improvement of 12*s* 4*d*, making £ 224 5*s* per year for the whole flock.

In the above, interest on the capital in sheep is calculated at 4 per cent., that is 8 ¼ *d* per head. Thus a total of 8*s* 3*d* per head per year ou a capital averaging 15*s* 8 *d* is equivalent to an interest of 53 per cent. (See Table on next page).

This is certainly the best result that I have found. I have, however, examined with the same care 45 farms, representing altogether 624 sheep-keeping seasons.

The total average shows a loss of 3*s* 10*d* per head per annum. The best result was a gain of 4*s*, the worst a loss of 12*s* 11*d*.

If rhe last five years are considered separately there is a slight improvement, as the loss is reduced to 3*s* 3*d*. It is satisfactory to note the individual good results, the best of which shows a profit of 8*s* 7*d*. Unfortunately for the reasons given above, and notwithstanding higher prices for wool and sheep, some farms have allowed their losses to grow, reaching as much as 15*s* 9*d* per head per annum.

Dr: *Summary of the Sheep-keeping Accounts of Farm No. 7/1912. From 1896-1897 to 1910-1911.*

Year	Average number of head	Average value at beginning of year		General expenses consisting of						Expenses		Wages		Total expenses up to this point		Fodder		Litter (straw)		General total		Profit per head	
				Management		Insurance		Rent of buildings		Rent of plant		Interest		Total											
		s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.
1896–97 to 1900–01. .	351.7	15	7.10	0	3.06	0	0.24	2	11.28	0	1.53	0	7.64	3	11.75	0	3.65	3	0.93	7	4.32	16	4.63	2	4.58	26	1.52	—	
1901–02 to 1905–06. .	324.–	15	4.87	0	3.76	0	0.24	2	7.16	0	0.71	0	8.58	3	8.45	0	5.29	2	11.63	7	1.38	13	2.76	2	10.34	23	2.48	1	10.00
1906–07 to 1910–11. .	382 5	15	4.87	0	4.00	0	0.24	2	2.70	0	2.00	0	8.82	3	5.75	0	5.88	3	3.04	7	2.67	15	0.52	2	3.64	24	6.82	7	7.38

Cr:

Year	Disposed of by sale, etc. — head	Sale price per head		Slaughtered — head	Died — head	Effectively sold — head	Wool and skins per head		Manure per head			Average value at end of year		Loss per head		Wool — per lb.
									in lbs,	in value						
		s.	d.				s.	d.		s.	d.	s.	d.	s.	d.	d.
1896–97 to 1900–01. .	164	26	7.17	4	32	128	3	11.63	3 245	5	9.38	15	3.46	4	9.27	4 3/4
1901–02 to 1905–06. .	156	29	0.21	1	13	142	4	5.74	3 168	5	7.74	15	8.98	—	—	5 1/2
1906–07 to 1910–11. .	212	36	2.06	1	10	201	5	7.03	3 694	6	6.91	15	0.28	—	—	7

In the above calculations the interest on the capital (taken at 1*s* as an average figure) has always been added to the expenses.

A comparison with the profits of pig keeping leads to the result that this branch really yields relatively larger profits where the farmer has the ability to profit by the quicker turnover of his capital and of the brisk trade in young pigs, which, especially for small farmers, are so much easier to dispose of than lambs.

On the other hand, when the interest and the ability of the farmer are lacking, the losses on pigs are greater than those on sheep. The total losses on pigs, however, in comparison with those on other branches of farming, in spite of greater losses per head, are not sufficiently considered, as these animals are generally kept in smaller numbers and to a certain extent as a secondary industry, mostly for consumption in the household itself.

In the year 1912 I examined 36 farms keeping pigs, representing together 563 years of accounts, and found that the average results were a loss of 12*s* 4 ½*d* per head per year. Considering only the last 10 years, the average loss is reduced to 9*s*. A calculation of the interest was not advisable, on account of the constantly changing ages of the animals.

As for cow keeping, a comparison with sheep keeping is difficult, as the manner of keeping them varies so much more than with sheep, as the chief product (milk) and the way it is utilized cause the whole character of the farm to vary.

According to my investigations, cow keeping is liable to much greater losses, which in reality frequently occur. The examinations of accounts have led more easily and quickly to improvements, as in cow keeping the greater part of the returns are received daily, and a comparison with the expenses is so much easier to make.

I refer here, as a striking illustration, to the figures given in my book (*Landwirtschaftliche Buchführung* 1903, I, page 23) in which the cost of the production of milk is worked out from the accounts of 603 farms. The average cost price is 6.9*d* per gallon, while the net price realized is 5.2*d* per gal., the loss being consequently 1.7*d* per gallon.

As at present the conditions of the sale of milk have not materially improved, except in some centres, and the number of cows has not increased to any notable extent, as statistics show, I can without hesitation use the above data for the discussion of the profitableness of cow keeping. Premising that about 10 million cows yield an average of 1.1 gallon of milk per head per day, or 4015 million gallons per year, the loss of 1.7*d* per gallon represents a total loss to German agriculture of about £28 500 000 per annum.

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SECOND PART.

ABSTRACTS

AGRICULTURAL INTELLIGENCE

GENERAL INFORMATION.

LEGISLATIVE AND ADMINISTRATIVE MEASURES.

1 – **New Legislation on Fertilizers, Feeding Stuffs and Insecticides in The State of New Jersey.** – *Thirty-third Annual Report of the New Jersey State Agricultural Experiment Station and the Twenty-fifth Annual Report of the New Jersey Agricultural College Experiment Station for the Year Ending October* 31, 1912, *passim.* Union Hill, N. J., 1913.

In the United States, 41 out of the 52 States possess legislation on the trade in fertilizers and almost always also on feeding stuffs, insecticides and seeds. After Massachussets in 1872, New Jersey was the second State to pass a law on the inspection of fertilizers. (Cf. *The American Fertilizer Hand Book*, 1913, p. 92 ; and *Cyclopedia of American Agriculture*, Vol. IV, Legislation Relating to the Trade in Fertilizers, pp. 515-518). (1)

The old fertilizer law of 1874 served its purpose well in protecting the farmers of the State against fraud in the purchase of plant food. Not only has it been a means for preventing the adulteration and misbranding of commercial fertilizers, but it has also served an educational purpose in acquainting the users of these materials with the sources and agricultural value of the various forms of plant food. Meanwhile, however, as methods of manufacture were modified and new fertilizer materials were placed on the market, it became increasingly apparent that the old law fell short of fulfilling the purpose for which it was created. It thus became necessary to revise it, and this was accordingly done. The new law (Chap. 179, Laws of New Jersey, 1912) will enable the Experiment Station by means of its chemical adviser, called the State Chemist, to make a more thorough inspection of the fertilizers sold in the State. It will give more ample protection both

(1) For the new Swiss law on the same subject, see No. 1313, *B.* Dec. 1913.

to the farmer and to the legitimate manufacturer of fertilizers. Having beeu placed on a licence basis, the fertilizer inspection will permit the employment of a larger number of official samplers and inspectors. Any surplus of the licence fees remaining after the actual cost of inspection has been met, will be used for conducting experiments bearing on the use of fertilizers and the improvement of soils and farm methods in general.

The New Jersey feeding-stuffs law was enacted in 1900. Since then changes have occurred in the manufacture and composition of many brands. New products have also been placed on the market and new definitions have been created by control officials. By mutual agreement, control officials and manufacturers have adopted certain definitions and standards and a uniform feed law has been formulated. The new law constitutes Chapter 218, Laws of New Jersey, 1912. The inspection under this law is also entrusted to the State Chemist and has been likewise placed on licence basis. A more thorough inspection has been provided for, and more ample protection will be afforded to both purchasers and manufacturers of commercial feeding stuffs. The licence fees collected will be used to cover the cost of inspection, and any surplus remaining will be devoted to investigations of feeding stuffs and such other investigations and demonstrations as will serve to further the interests of agricultural practice.

The far-reaching changes introduced within the last five or six years in the manufacture and use of insecticides rendered necessary the revision of the insecticide law of 1906. The revised law constituting Chapter 89, Laws of New Jersey, is practically a copy of the Federal Insecticides Law. An appropriation of $ 1000 per annum has been made for carrying this law into effect. The amount appropriated is not sufficient for meeting the cost of the inspection. It is expected, however, that the general income of the Experiment Stations will be ample enough to meet any deficiency that may arise. Under the revised law, the fruit growers and market gardeners of New Jersey will be more certain to secure the protection and information so essential in the uninterrupted development of their important industry.

Great losses are suffered annually by the farmers of New Jersey on account of the poor seed purchased by them. The need of some guarantee that would help the purchaser to secure seeds relatively free from weed seeds and possessing a high germination coefficient was keenly felt by the farmers of New Jersey, and the director of the Experiment Station was instrumental in framing a measure that promises to afford the relief sought. The seed law as passed, constituting Chapter 157, Laws of New Jersey, 1912, will permit the Experiment Station to collect samples of seeds sold in the State, to test them for germination and purity and to publish annually the results of the seeds inspection. Residents in the State will have the privilege of having seeeds analysed for them without charge. It is expected that the publicity given in this manner to the seed trade will serve effectively to discourage the selling of inferior seed in the State. The enforcement of the law will be entrusted to a State Seed Analyst.

2 – **Development of Farming in German South-West Africa.** — BERTHOLD, HANS in *Landwirtschaftliche Umschau*, Year 5, No. 46, pp. 1051-1053. Magdeburg, November 14, 1913.

Farming has of late years made relatively considerable progress in German South-West Africa; thus, in the district of Windhuk alone the area under cultivation rose from 230 acres in 1907 to 4606 acres in 1912. Still more important is the progress in live-stock breeding, as may be seen from the following table, which gives the numbers of head on April 1 of the years 1903, 1907 and 1912:

	1903	1907	1912
Cattle	90 385	52 189	171 784
African sheep	182 541	98 069	442 481
Wool sheep	4 201	3 526	46 901
African goats	156 727	99 563	448 279
Angora goats	3 391	3 696	20 431
Horses	5 265	3 119	13 340
Mules	88	4 216	4 879
Asses	899	1 630	7 015
Camels	3	487	789
Pigs	690	1 202	7 195
Persian sheep	—	—	12 588
Karakuls	—	—	4 094
Ostriches	—	—	1 277

The chief factors which determine the rapidity of the development of farming in new countries are the market conditions, the attention paid to the scientific basis of agriculture in the protectorate, and the conditions of credit. As for the market conditions, which are at present still very unfavourable, a suitable organization of the trade in and utilization of live stock, especially of the wool and ostrich feather trades, would be very beneficial. The protectorate should be provided with scientists (veterinary surgeons, bacteriologists, entomologists, foresters, botanists, chemists, experts in general agriculture and specialists for tobacco growing, animal husbandry, fruit growing and preserving), and the institution of experimental and model farms should be extended and perfected.

The writer anticipates notable advantages from the recent institution of an "Agricultural Bank for South-West Africa", with a capital of 10 million Marks (about £ 500 000) and the right to issue land mortgage bonds for ten times this amount. The object of the bank is to satisfy the three forms of credit: credit on the land, credit for improvements and personal credit, the latter by means of institutions such as cooperative associations already existing or to be founded.

3 – **Agriculture in the Belgian Congo.** — LEPLAE, E. in *Bulletin Agricole du Congo belge*, Vol. IV, No. 1, pp. 324, 153 figs., 3 plates. Brussels, March 1913.

This Bulletin consists entirely of the report presented to the Colonial Minister on agriculture in the Belgian Congo and gives a precise account of the agricultural conditions of the colony.

The writer considers in detail the important question of the colonisation of the equatorial part of the Congo; he enumerates the disadvantages under which agriculture labours and suggests the following reforms:

1) Easier conditions for the purchase and choice of agricultural land, particularly for plantations of less than 750 acres.

2) Ten years' exemption from taxes for agricultural buildings.

3) Suppression of import duties on materials required on plantations and of labour taxes.

4) Abolition of export duties on agricultural products and cheaper rates of transport.

5) A speedy organization of agricultural credit.

RURAL HYGIENE.

4 – **On the Hygienic Organisation of Workers in the Tropics.** — GERRARD, P. N., 80 pp. Singapore, 1913.

The writer lays special stress on the diseases most prevalent in the tropics, indicating means of avoiding and combating them. As an appendix the work contains plans of hygienic dwellings for natives.

EDUCATION AND EXPERIMENTATION IN AGRICULTURE AND FORESTRY.

5 – **Agricultural Instruction for Soldiers.** — HANNE, R. in *Milteilungen der Deutschen Landwirtschafts-Gesellschaft*, Year XXVIII, Part 47, pp. 636-642. Berlin, November 22, 1913.

The writer has attempted, by means of questions adressed to 220 teachers engaged in the agricultural instruction of soldiers, to arrive at some practical conclusions regarding the general success of the system which has been in operation in Germany for five years, and to gage the interest aroused in the students by the method of instruction, the time of instruction, excursions and inspections, and the use of demonstration material, etc.

6 – **The Agricultural and Veterinary College at Rio de Janeiro, Brazil** (1). — *Boletim do Ministerio da Agricultura, Industria e Commercio*, Year 2, No. 3, pp. 107-123. Rio de Janeiro, 1913.

On July 10, 1913, the Agricultural and Veterinary College at Rio Janeiro was opened, its foundation having been determined by the Decree of October 20, 1910, dealing with the organisation of agricultural instruction in Brazil. In its first term, the College was attended by 52 agricultural students, 8 veterinary students and 5 unattached students. An experiment and demonstration farm of about 470 acres is under the management of the College.

7 – **Agricultural Demonstration Train at Rosario de Santa Fé (Argentina).** — *Boletim do Ministerio da Agricultura, Industria e Commercio*, Year 2, No. 2, pp. 104-107 + 4 figs. Rio de Janeiro, 1913.

The writer describes the arrangement of the new agricultural demonstration train at Rosario, which has been running since the beginning of 1913 in the provinces of Santa Fé and Cordoba in the Argentine, and which consists of two railway cars, of which one is the lecture room (to accomodate 40 people) and the other is devoted to the scientific material for instruction on plant diseases.

(1) See No. 638, *B.* June 1913. (*Ed.*).

8 – **The "Société Nationale d'Agriculture de France".** — WERY, GEORGES in *La Vie agricole et rurale*, Year 2, No. 51, pp. 645-651. Paris, November 22, 1913. AGRICULTURAL INSTITUTIONS.

The writer gives a short summary of the history of the National Agricultural Society of France from its establishment in 1760 by Bertin, De Turbilly and Bertier de Sauvigny, until the present day. He describes the condition of agriculture in France at the time of the foundation of this society, the circumstances of its establishment, the experiences of the society during the great social changes which have taken place in France, the activity of the Society in the publication of works dealing with scientific agriculture, and in the promotion of agricultural instruction and research. In conclusion a list is given of the eminent scientific and practical men whose names are most closely associated with the history and success of the Society.

9 – **Agricultural Shows.** AGRICULTURAL SHOWS AND CONGRESSES.

Brazil.

1914. April (opening 21st). Minas Geraes. — Agricultural and live-stock show.

France.

1914. Feb. 26 - March 2. Cannes. — Flower show, organized by the "Société d'Horticulture et d'Agriculture de Cannes". Sec.: rue Châteaudun 19, Cannes.

Hungary.

1914. May - June. Budapest. — International wine and vine-growing show, organized by the Chamber of Commerce.

Russia.

1914. April. St. Petersburg. — International horticultural show.

Spain.

1915. Barcelona. — International exhibition of electric industries and applied electricity.

United Kingdom.

1914. March 18-19. Belfast, Balmoral. — Show and sale of Aberdeen Angus bulls, cows and calves, organized by the Royal Ulster Agricultural Society.

Uruguay.

On the initiative of the Ministry of Industry, the "Asociación Rural del Uruguay" (Montevideo) will organize two exhibition-fairs yearly, on the second Sunday in March and on Aug. 25 respectively. The first will include particularly live stock, crops, market-garden produce, flowers, poultry and connected industries and machines; the second forestry, fruit-growing, poultry, bees and connected industries and machines.

10 – **Agricultural Congresses.**

Belgium.

1914. April. Ghent. — Congress on the bettering of rural conditions, organized by the "Commission nationale pour l'embellissement de la vie rurale". General sec.: M. Verstraeten, 15 place van Artevelde, Ghent.

France.

1914. Feb. 17-20. Paris. — Annual congress of the "Société nationale d'encouragement à l'agriculture", held during the General Agricultural Show in Paris.

Hungary.

1914. May - June. Budapest. — National wine and vine-growing congress, held on the occasion of the International Wine-cellar Exhibition.

United Kingdom.

1915. May 22-29. London. — Fourth International Botanical Congress. General sec. of organization committee: Dr. A. B. Rendle, British Museum (Natural History), Cromwell Rd., London S W.

CROPS AND CULTIVATION.

SOIL PHYSICS, CHEMISTRY AND MICROBIOLOGY.

11 – **The Selection of Land for Plantation in the Tropics.** — WOLTMANN in *Jahrbuch der Deutschen Landwirtschafts-Gesellschaft*. Vol. 28, Part 1, pp, 246-262. Berlin, May 1, 1913.

The writer has often had occasion to observe that the lack of success of plantations has been due to errors in the selection of the land.

When a farmer intends utilizing virgin soil for a plantation he should in the first place examine with attention the vegetation on it and the forms that it assumes ; as the vegetative conditions of a district depend chiefly upon the climate, it may be said that the susceptibility to cultivation of a soil is determined in the first place by *climatic conditions*, and of these the prevailing factors are *temperature* and *rainfall*.

Within the limits set by climate, the soil with its various properties becomes the decisive factor. In the first place there are the *ecological* factors in general and then the *geological* ones.

From the point of view of the latter the origin of the soil has to be investigated, that is from what rocks and by what process of decomposition it has been formed ; thus there are red soils, yellow soils and laterites widely spread in the tropics. Further the distinction between sedentary and transported soils must be noted. The study of the subsoil is also very important, especially from the point of view of moisture conditions.

For the *mechanical analysis* of tropical soils, the writer proposes the following form :

Tropics :
Sample of Soil No. from

I. A depth of 1 metre (3ft. 3 in) in four sections of about 10 inches each, if the soil is deep and uniform : each sample should weigh about 12 lbs.

If the soil is not homogeneous, or is in layers, or is superficial, the samples are to be taken from the various strata or formations in quantities of 9 to 13 lbs. as limits.

II. Rocks in course of weathering (about 4 ½ lbs.) } when present.
III. Unweathered rock (,, ,,) }

The samples must be most carefully dried, catalogued and packed, and accompanied by the following data :

1. Plantation and situation.
2. Name of field.
3. Name of owner.
4. Geological formation.
5. Dip.
6. If the soil is under pasture, cultivation, steppe, plantation, etc., or virgin forest.
7. Depth of arable soil.
8. Depth of loosened soil.
9. At what depth rubble is met with.
10. At what depth the rock is found.
11. Description of the section at every 4 inches in depth up to 1 metre (3ft. 3 in).
12. If water is present in the subsoil and at what depth.

13. Chief crop (coffee, cacao, cotton, tobacco, etc.).
14. Yield of the more important crops in normal years.
15. If manuring is practised, and if so, how often, and at what rate per acre with the various classes of manure.
16. Price or rent of the land.

For the mechanical analyses of the soil the writer finds Benningsen's method useful. It is to be noted that in the tropics humus has not the importance that it has in temperate regions, though very important for certain crops, such as cacao, vanilla, coffee and pepper. The mechanical analysis is also important for irrigation work in the tropics.

In *chemical analysis* the first step is the investigation of lime content, which is to be done on the spot, using hydrochloric and not acetic aid. Arid soils in the tropics are very rich in lime, while moist ones contain very little of this element. Now certain crops require lime: such are coffee, sugarcane, and among Leguminoseae especially earthnuts; other crops are more or less indifferent: thus maize and sorghum thrive in washed-out soils containing a minimum of lime.

In general, the writer believes that a tropical soil may be considered good and suitable for a plantation from the point of view of its capital in fertilizing substances, when it contains:

Soluble in cold hydrochloric acid:

lime + magnesia	0.2 to 0.5 per cent.
potash	0.1 » »
phosphorus pentoxide	0.1 » »
nitrogen	0.1 » »

The following form is proposed for the chemical analysis of tropical soils (see next page):

The determination of the *absorbent power* of the soil is important, especially in connexion with the prevalence in the tropics of red and yellow soils possessing a marked power of absorbing ammoniacal nitrogen and with the abundance of nitrogen in the rainfall of the tropics; thus a yearly rainfall of 120 inches brings down about 72 lbs of nitrogen to the acre.

As for *bacteriological properties* the writer has observed the development of Leguminosae without nodules; nevertheless the practice of inoculation in spreading their cultivation may turn out favourable, especially for soy beans and earthnuts.

Turning to special crops, it may be said that *cacao* requires deep, warm and soft soils, rich in nutritive substances, especially potash, and not marshy. *Coffee* requires in the first place a soft soil, moderately moist and rich in plant food, so that it does not thrive on poor sandy soils or on lateritic ones. *Nutmegs* are very exacting as to soil, which must be of the best, and climate, which must have a uniform temperature from 69 to 90° F. and much rainfall. *Vanilla* demands humous soils, moist composts rich in plant food. *Sisal hemp* is suitable for those districts where the conditions of moisture are not of the best, being satisfied with 12 to 20 inches of yearly rainfall. *Cotton* grows on all kinds of soils excepting peaty or purely sandy ones;

Designation				
Depth	0-25 cm. (10 inches)	25-50 cm. (10-20 in.)	50-75 cm. (20-30 in.)	75-100 cm. (30-40 in.)
Content in	per cent.	per cent.	per cent.	per cent.
Fine soil (under 2 mm.)				
Moisture				
Loss on ignition				
Nitrogen				
Absorbent power for ammonia				
Substances soluble in cold hydrochloric acid (450 gms. of fine soil for 48 hours with hydrochloric acid of S. G. 1.15)				
iron and alumina . . .				
of which iron				
» alumina . . .				
silica				
lime				
magnesia				
phosphorus pentoxide. .				
potash				
Substances soluble in boiling hydrochloric acid (50 gms. fine soil on water bath with 50 c. c. of hydrochloric acid S. G. 1.15)				
potash				
Class of soil (I to VIII) according to the content in fertilizing matter				
Remarks (nature of the soil, suitable crops, etc.) . . .				

nevertheless, account has to be taken of the subsoil and of the climate, and varieties must be selected which can avail themselves of two or three months' rain. *Jute* wants moist alluvial soils. *Rubber* has no special requirements, save for the fineness of texture, which maintains that

moisture which seems to favour greatly the formation of latex. *Tan acacias* prefer the dry soils of arid regions. *Earthnuts* like deep and soft soils, never too moist, with sufficient lime and enough water for growth during the first few months. *Palms* behave differently according to their species: thus *coconuts* thrive on all soils except those containing stiff clay either on the surface or in the subsoil; the best are sandy coral soils and basaltic soils, even if rocky, provided they have not undergone weathering to clay; *date palms* must have abundant irrigation; *oil palms* grow on all soils, but prefer light sandy ones; *sago palms* prefer marshy lands. *Tuber and rhizome crops*, many species of which form the staple of the natives' food, thrive best on loose soft, deep, humous soils free from stones. *Bananas* do not like clayey soils, otherwise they grow everywhere, benefiting by organic manuring. *Maize* and *sorghum* have no special requirements, while *tobacco* prefers soft, warm, deep, humous soils rich in plant food and with sufficient potash.

As for the use of manures, the idea that tropical soils are inexhaustible is now exploded; on the contrary it may be said that they get exhausted easily (1). In such cases they are manured or left fallow, or they are abandoned for new lands. Which of these methods is to be preferred depends upon the economic conditions, especially the cost of manuring. It is to be considered that manuring has the effect of not only increasing the crops but also ensuring them; and if sometimes, as for instances with tobacco (Havana), it may injure the quality of the crop, it may be said that in general it keeps the plants healthier. But perhaps the most important effect of manuring is that of prolonging the duration of plantations; thus, for instance, whilst cocount palms live usually about 70 years, the use of manure prolongs their productive existence to 80 and 100 years; for coffee, also, a suitable and early manuring may prolong the life of the plantation by 5 or 10 years.

It is to be expected that systematic experimentation, such as the German Colonial Office and the Colonial Section of the German Agricultural Society have already undertaken in the German Colonies, will give the same results as it has given in Germany (2). Greater care is, however, necessary in the choice of the manures; thus in the moist tropical regions and especially on ferruginous soils, a deficiency of phosphoric acid is hardly to be feared; potash salts mostly give good results in the regions of abundant rains, whilst potash abounds in the arid belts; in general nitrogenous manures are not to be recommended in the tropics as they are in the temperate zones; lastly when liming is required it must be done under the form of marl or ground limestone, quicklime being rather too energetic in tropical soils. In a general way it may be said that the colonial farmer must pre-

(1) See No. 1278, *B.* Sept. 1913. (*Ed.*).

(2) See N . 480, *B.* May 1913, and BUSSE, W. (Director of the Imperial German Colonial Bureau). The Organization of Experimental Work in the German Colonies. — *Bulletin of the Imperial Institute*, Vol. XI, No. 3, pp. 462-468. London, July-September 1913 (*Ed.*).

fer the less easily soluble manures to the more soluble ones, especially in those regions having a high rainfall which easily leaches the soil : thus sulphate of ammonia and Peruvian guano are to be preferred to nitrate of soda ; and bone meal to superphosphate, the soluble phosphoric acid of which rapidly retrogrades in red and yellow soils.

12 – **The Soil Solution and the Mineral Constituents of the Soil.** — HALL, A. D., BRENCHLEY, W. E., and UNDERWOOD, L. M. (Rothamsted Experiment Station) in *Philosophical Transactions of the Royal Society of England*, Series B, Vol. 204, pp. 179-200. London, October 21, 1913.

The following investigations were undertaken to examine: 1) the effect of fertilizers on the concentration of the soil solution ; 2) the effect of solutions of different concentrations on the growth of the plant ; 3) the effect of distributing the food solution over solid particles (such as sand, silt, clay) on its availability to plants growing in such media.

The first question was attacked by treating soil from certain plots of known history with tap water and using the liquid thus obtained for water cultures. The moist soil as it came from the field was mixed with tap water in the proportion of 20 kg. of dry soil to 25 litres of water. After thorough mixing, the soil was allowed to settle, and the supernatant liquid was siphoned off, filtered, and run into 600 c. c. bottles, into which seedlings were set. The contents of the bottles were renewed at fortnightly intervals. Each unit of comparison consisted of 10 plants, and to further minimise disturbing factors, the experiments were carried out in early spring when the most satisfactory growth is obtained.

The soils were drawn from both the permanent wheat and the permanent barley fields, and plots were selected having received the following treatment :

1). Unmanured, or U.
2). Received nitrogen only annually, or N.
3). » nitrogen and phosphoric acid annually, or N. P.
4). » nitrogen and potash annually, or N. P.
5). » complete artificial fertilizer annually, or N. K. P.
6). » dung annually, or D.

As the problem under investigation was not concerned with the nitrogen supply, this factor was eliminated by adding sodium nitrate to all solutions at the rate of 0.25 gm. per litre. Both wheat and barley (pure lines) were grown in each solution for a period of 8 weeks, after which the plants were removed, dried and weighed.

The mean results are set out in Table I.

The growth in the solutions from the various soils shows differences which are parallel to those obtained in the crops on the same plots. Further, the growth in the solutions is such as would be anticipated from the composition of the solutions, large quantities of which were evaporated and analysed with the results set out in Table II (p. 48), where the analyses of the soils used and the amounts of the fertilising elements applied in the manure are also given.

TABLE I. — *Mean dry weight of plant in gms.*

Soil	Wheat			Barley		
	Shoot	Root	Total	Shoot	Root	Total
Wheat field, Plot *U.*	0.170	0.135	0.305	0.212	0.105	0.317
» » *N.*	0.157	0.127	0.284	0.171	0.101	0.272
» » *N. P.* . . .	0.598	0.260	0.858	0.660	0.175	0.835
» » *N. K. P.* .	0 923	0.448	1.371	1.302	0.442	1.744
» » *D.*	1.137	0.425	1.562	1.249	0.377	1.626
Barley field, Plot *U.*	0.240	0.169	0.409	0.264	0.138	0.402
» » *N. P.*	0.476	0.199	0.675	0.611	0.137	0.747
» » *N. K.*	0.208	0.201	0.409	0.275	0.119	0.394
» » *N. K. P.* . . .	1.203	0.627	1.830	1.600	0.477	2.077
» » *D.*	1.195	0.511	1.706	1.364	0.486	1.850

It will be seen that the composition of the soil solution reflects the manurial history of the plots, and corresponds to that of the soil as judged by either the " total " or the " available " plant food it contains.

The following year (1912) the experiments were resumed, and, as the results given by the wheat and barley soils had been so similar, they are on this occasion confined to solutions made from the barley soils only. In order to examine further the conclusion that no other factor entered into the effects produced by the soil solutions than the amount of plant food they contained, comparisons were made between : 1) a culture solution made up in the laboratory to the same concentration in essential nutrients as the solutions from the completely manured soils (4.7 parts per million $P_2 O_5$ and 26.7 parts per million K_2O) ; 2) the soil solutions ; 3) the soil solutions from the partially manured plots, with their essential deficiencies repaired by the addition of phosphoric acid or potash or both ; 4) a further artificial solution was made up to a much higher concentration, to one in common use in the laboratory; lastly, 5), the salts in this artificial solution (303.5 parts per million $P_2 O_5$ and 312.4 parts per million K_2O) were added to the soil solutions. As before, in all cases sodium nitrate was added at the rate of 0.25 gm. per litre or 41 parts of nitrogen per million. Barley plants were grown for 7 weeks with the results set out in Table III.

From these results, the following conclusions may be drawn. The artificial culture solution of low concentration yielded plants whose weight (0.763) was distinctly lower, but of the same order as these grown in the soil solutions from the completely manured plots (0.963 and 1.465). The artifi-

TABLE II.

Field and Plot	Phosphoric Acid				Potash			
	In soil solution	In soil		Manure annual supply	In soil solution	In soil		Manure annual supply
		Total	Citric acid soluble			Total	Citric acid soluble	
	parts per million	per cent	per cent	lbs. per acre	parts per million	per cent	per cent	lbs. per acre
Wheat, Plot *U*, ...	0.656	0.114	0.0078	0	3.64	0.220	0.0032	0
» » *N*.	0.881	0.123	0.0074	0	3.55	0.240	0.0032	0
» » *N.P*.	3.839	0.197	0.0405	60	3.88	0.197	0.0032	0
» » *N.K.P*. . . .	3.938	0.195	0.0547	60	26.22	0.262	0.0232	100
» » *D*. . . .	4.838	0.215	0.0560	46	29.85	0.285	0.0384	60
Barley, Plot *U*	0.525	0.099	0.0055	0	3.40	0.183	0.0036	0
» » *N.P*	3.900	0.173	0.0425	60	3.88	0.248	0.0023	0
» » *N.K*	0.808	0.102	0.0081	0	30.33	0.257	0.0407	100
» » *N.K.P* . . .	4.025	0.182	0.0500	60	24.03	0.326	0.0298	100
» » *D*. . .	4.463	0.176	0.0447	46	26.45	0.167	0.0321	60

cial culture solution of high concentration yielded heavier plants (0.943), approaching those obtained from the completely manured soils, though still below the maximum. The soil solutions from the unmanured plot and the imperfectly manured plot (N. P.) yielded plants of a much lower order of magnitude (0.216 and 0.486). The addition of the missing nutrients to the solutions from the imperfectly manured soils produced growth approaching the maximum (1.214 and 1.154); when the nutrients were added to set up the higher concentration, the growth produced was equal to that obtained from the artificial culture solution of the same concentration (0.974 and 0.925 against 0.943) though still below the maximum.

These results confirm the conclusion drawn from the previous set of experiments: that the growth of plants in the soil solutions is in the main determined by the amount of plant food the latter contain. One other point was suggested by the results: that the soil solutions, particularly those from the dunged plot, were better media for growth than the artificial culture solutions of equivalent concentration, possibly owing the the presence of soluble nitrogen compounds especially valuable to the plant in the earlier stages of growth. On the other hand, it is unsafe to lay much stress on such differences in weight as are exhibited in the growth of the plant in the solutions regarded as complete (0.943, 1.214, 0.974, 1.154, 0.925, 0.063, 1.349 1.465, 1.286).

TABLE III.

Nature of solution	Dry weight in grms.		
	Shoot	Root	Total
Artificial culture solution, low concentration	0.514	0.249	0.763
» » » high »	0.652	0.291	0.943
Soil solution, Plot *U*.	0.116	0.100	0.214
» » » + added salts, low concentration . . .	0.865	0.349	1.214
» » » » » » high » . . .	0.677	0.297	0.974
» » Plot *N. P.*	0.353	0.133	0.486
» » » + added salts, low concentration .	0.795	0.359	1.154
» » » » » high » .	0.619	0.306	0.925
» » Plot *N. K. P.*	0.685	0.278	0.963
» » » » + added salts high concetration	0.926	0.423	1.349
» » » » Plot *D.*	1.069	0.396	1.465
» « » » + added salts high concentration	0.814	0.472	1.286

These conclusions were checked by two further sets of experiments, where first barley and then peas were grown in the artificial culture solution of low concentration; in soil solutions with their phosphoric acid and potash made up to standard by the addition of mineral salts; in soil solutions made up above standard strength; and lastly a set was included from which the sodium nitrate was left out. The results of these series were in complete accord with those of the preceding series. The addition of nitrogen alone to the soil solutions produced no increase in the plant, indicating that the soils themselves had yielded more than enough nitrate for the needs of the plant, the growth of which had been limited by the amount of phosphoric acid and potash present in the solution. The evidence for the presence in the soil solutions, even in those from the dunged plots, of other substances favourable to growth was slight.

Analyses of drainage waters from the wheat plots during the progress of these experiments showed that, though always more dilute, the drainage waters followed the same sequence as the soil solutions with regard to their content of phosphoric acid and potash.

The results of these experiments also bear on the question of plant toxins left behind by one crop and having a depressing effect on succeeding crops of the same kind. The wheat and barley in Table I yielded almost exactly the same weight of plant in the solutions from the wheat soils and in the solutions from the barley soils, the latter yielding slightly heavier plants with both cereals. Again, wheat and barley grown in the same solution yield weights agreeing within the range of error of such experiments. These facts alone would indicate the absence in the soil of any soluble toxin injurious to either plant; but the investigation was pushed a step further by comparing the growth in an artificial culture solution, in a set of soil solutions boiled before use, and in another set where the solutions were evaporated, the residues ignited, and then dissolved afresh. The boiling was without effect and igniting the residues generally had a depressing effect on growth. The results were confirmed by similar experiments with lupins, sunflowers and buckwheat and with the peas mentioned above; the growth of the other plants corresponded with that of the wheat or barley.

The relation between the growth of the plant and the concentration of the nutritive solution, as distinct from the total amount of the nutrients supplied, was also investigated independently of the soil solutions. A standard culture solution was made up containing 0.5 gm. each of potassium di-hydrogen phosphate, magnesium and calcium sulphates, and sodium chloride, 1.0 gm. of potassium nitrate, and 0.04 gm. of ferric chloride, equivalent to N 138, P_2O_5 261, and K_2O 743 parts per million. Barley was grown in bottles containing 600 c.c. of the above solution, at full strength, and diluted to $^1/_5$, $^1/_{10}$ and $^1/_{20}$ respectively, the trials being made in duplicate only. Growth proceeded for 8 weeks with the results set out in Table IV.

From the very outset the growth in the various solutions proceeded in the order of their concentrations, so that the final weights may be taken to represent the rates of growth throughout and not an ultimate condition brought about by the exhaustion of the food supply, though the more dilute solutions were at the finish depleted of the nitrogen they originally contained. To obviate the effects of this depletion a second set of experiments was carried out, in which the solutions were renewed weekly, the other conditions remaining as before. Confirmatory results were obtained. Then a new series was arranged in which the plants were grown in coarse sand contained in vertical glass cylinders through which the nutritive solution slowly percolated. The cylinders contained 800 gms. of coarse sand mixed with 4.25 gms. of calcium hydrogen phosphate (the potassium phosphate was withdrawn from the nutritive solution), and 100 c.c. of the nutritive solution daily was allowed to drip very slowly on the sand, percolate through it, and escape. Growth was continued for two months, with the results set out in Table V.

The solutions escaping from the sand were regularly tested and found to contain nitrate, except in the last weeks of growth with the more dilute solutions.

ACC no 5836

TABLE IV.

Concentration of solution	Dry weight in gms.		
	Shoot	Root	Total
1	1.323	0.332	1.655
	1.605	0.470	2.075
1/5	0.977	0.268	1.245
	1.087	0.405	1.492
1/10	0.742	0.288	1.030
	0.690	0.253	0.943
1/20	0.462	0.219	0.681
	0.369	0.168	0.537

TABLE V.

Concentration of solution	Dry weight in gms.		
	Shoot	Root	Total
1	2.969	0.769	3.738
	2.393	0.787	3.180
1/5	1.218	0.304	1.522
	1.698	0.555	2.253
1/10	1.148	0.690	1.838
	0.837	0 221	1.058
1/20	0.488	0.280	0.768
	0.603	0.308	1.011

Two more sets of experiments were carried out in which barley and lupins were employed as test plants and 500 c. c. of solution was dropped though daily. As it was late in the season for satisfactory work, the results were a little erratic, but there could be no doubt of the superiority of plants growing in solutions of higher concentration.

The whole series of experiments confirms the conclusion previously reached that the concentration of the nutritive solution within certain wide limits, irrespective of the total amount of plant food available, is a factor in the rate of plant growth which varies directly, though not proportionally, with the strength of the solution in the particular nutrient or nutrients limiting the growth.

To investigate the third question mentioned above (*viz.* the effect of distributing the food solution over solid particles on its availability to plants), plants were grown simultaneously in water cultures and in sand cultures where 600 c.c. of the food solution was mixed with 3 kg. of fine silver sand (above 0.2 mm. in diam.), these being the proportions required to work the sand up into a fine "crumb" structure. Barley was the trial plant, and the same solutions varying in concentration from 1 to $\frac{1}{20}$ were employed. Every two or three days the jars containing the sand were weighed, and the original water content restored by the addition of pure water. Table VI shows the results obtained.

TABLE VI.

Concentration of solution	Dry weight of plant in gms.	
	Water	Sand
1	1.655	7.050
	2.075	4.200
$\frac{1}{5}$	1.245	3.539
	1.492	3.031
$\frac{1}{10}$	1.030	3.171
	0.943	2.882
$\frac{1}{20}$	0.681	1.556
	0.537	1.437

Far from there being any retardation of growth in the sand due to slowness of diffusion of the nutrients in the water films, the sand cultures

were markedly superior to the water cultures, though as before the rate of growth varies with the concentration of the nutrients in the solution. Confirmatory results were obtained when the experiment was repeated and the nutrients (in a concentrated form) were placed inside narrow cylinders of porous earthenware themselves filled with sand and packed in the sand in which the plant was growing. In this case the roots never came into contact with the nutrient solution until it had diffused through the porous cell into the mass of sand beyond.

To extend these experiments to solid media made up of finer particles than the silver sand, a large quantity of a sandy soil was graded into "coarse sand" as before, "fine sand" (0.2-0.04 mm.) and "silt" (0.04 — 0.01 mm.), while pure kaolin was taken to represent a clay material. The same solution was diffused through all the materials. Barley, and later lupins, were grown in each medium with the following results (Table VII).

TABLE VII.

Nature of medium	Dry weight in gms.					
	Barley			Lupins		
	1.	2.	Mean	1.	2.	Mean
Water	1.350	1 190	1.270	0.822	1.162	0.942
Coarse sand	1.456	1.369	1.412	2.486	2.462	2.474
Fine sand	0.581	0.624	0.602	0.896	1.367	1.131
Silt	0.800	0.472	0.636	1.416	1.371	1.393
Kaolin	1.026	0.719	0.872	1.742	1.925	1.833

Through an accident the barley in the water cultures received twice the volume of the solution diffused through the solid media, but even here the coarse sand preserved its superiority. With the lupins, growth in each of the solid media proved superior to that in the water culture, so that the possibility of retardation of growth due to slowness of difusion may be dismissed. To explain the superiority of the cultures in sand over the water cultures, and again the superiority of the cultures in coarse sand and kaolin over those in fine sand and silt, the writers were led to suspect, by the appearance of the roots, differences in the aeration of the root as a disturbing factor. Both the coarse sand and the kaolin remained in an open state, while the fine sand and the silt settled down to a compact mass. To test this hypothesis, the effect of continuous aeration was tried on water cultures, in the case of both barley and lupins ; an increase of 60 to 80 per cent. was obtained by the aeration. Finally, another set of experiments was carried out in which the water was added to the solid media from below,

so as to obviate as much as possible the settlement of the silt. Settlement still occurred, but the growth was made more nearly equal, though the results are not conclusive as to whether aeration is the only factor concerned, and whether the fines particles in the kaolin and silt are not holding back some of the nutrients from the plants by " adsorption ".

The net result of the whole investigation is to restore the earlier theory of the direct nutrition of the plant by fertilizers. The composition of the soil solution, which determines the growth of the plant, is dependent upon the amount and the mode of combination of the phosphoric acid and potash in the soil, both of which are affected by the fertilizer supply, though to what extent is not yet determinable.

13 – **The Influence of Salts Common in Alkali Soils upon the Growth of the Rice Plant**. — MIYAKE, K. (College of Agriculture, Tohoku University, Japan) in *The Journal of Biological Chemistry*, Vol. XVI, No. 2, pp. 235-263. Baltimore, November, 1913.

Rice plants were grown in water cultures of varying concentrations of salts of sodium, potassium, magnesium and calcium, separately and in combination.

The growth of the plants under the different conditions was noted and the following results obtained :

A. — Single salts of the above metals.

1) The salts act as stimulating or toxic agents according to the concentration.

2) The toxic concentrations of magnesium sulphate and chloride, calcium chloride and sodium chloride and carbonate are greater than $\frac{N}{100}$, while those of sodium sulphate and bicarbonate are greater than $\frac{N}{50}$.

3) The concentrations of greatest stimulation were for magnesium sulphate $\frac{N}{500}$ for magnesium chloride and calcium chloride $\frac{N}{1000}$ to $\frac{N}{5000}$, for sodium chloride $\frac{N}{50}$ to $\frac{N}{100}$, for sodium carbonate and bicarbonate $\frac{N}{100}$ to $\frac{N}{500}$.

B. — Two salts in combination.

4) Different cations are mutually antagonistic; the same effect occurs between different anions, but in a less degree. Thus the limit of concentration producing toxic effects is higher in mixtures of salts.

5) The curve for concentration and antagonism between sodium and potassium salts shows two maxima.

6) The antagonism between potassium and magnesium or calcium is almost complete, so that at certain proportions the toxic effect completely disappears.

7) The antagonistic action of calcium cannot be replaced by barium or strontium.

These results have considerable bearing on soil fertility, especially in alkaline soils.

14 – **Culture Experiments on Sick Soils.** — PERITURIN, TH. T. in *Isviestia Moskovskago Selskokhosiaistvennago Instituta*, Year XIX, Part. 4, pp. 1-137 (138-141), figs. 35. Moscow, 1913 (1).

The writer mentions the opinions of those American workers who hold that soil sickness is due to the presence in the soil of substances injurious to plants, which are produced by excretion from the plants themselves or, as has lately been believed, by independent formation in the soil. He then recalls Istsherekov's experiments, according to which a repeated lixiviation of a sick soil seems to have had a favourable effect on plant development, this effect being attributed to the removal of the injurious substances.

Lastly, according to experiments carried out by the writer, who made three successive cultures of oats in distilled water, this injurious action was not observed (2).

It was different in a series of sand-culture experiments. In glass vessels filled with pure quartz sand and treated with Hellriegels nutritive solution, several kinds of plants were grown in succession (up to three following one another) for a six weeks' period. In almost all the experiments the plants of the second sowing seemed to be sickly ; the weight of 10 plants when they were gathered, referred to the first crop taken as 100, is given in the accompanying table.

The unfavourable effect on the second crop in the majority of cases is evident. On adding to the pots 15 grams of pure powdered charcoal after the first crop, the unfavourable effects cease and the plants of the second cultivation develop as well as those of the first. The results may be summarized as follows :

1. — Through repeated cultures in the same pots the plants assume abnormal characters owing to which the yield of the second sowing is considerably diminished.

2. — The root residues of the first crop, on decomposing, cause in some way the diminution of the yield of the second crop.

3. — The abnormal development of the second culture cannot be attributed wholly to the alkalinity of Hellriegel's solution after the first culture.

4. — The abnormal development of the second culture is observed both when the same plant is cultivated in immediate succession or after alternating with plants of other botanical groups.

5. — The addition of charcoal prevents the unfavourable effects on the second culture.

In another series of experiments, cultures were made in glass vessels filled with earth from various localities in Russia. Oats and wheat were

(1) Our article is substantially a translation of the author's summary in German. (*Ed.*).

(2) Some recent experiments, of a preliminary character, seem to confirm in the case of peas in water-cultures the excretion from the roots of substances poisonous for the same plant, both in distilled water and in river water. (MOLLIARD, M. Sur la sécrétion par les racines de substances toxiques pour la plante. — *Bullettin de la Société Botanique de France*, Year LX, Part. 5, pp. 442-446. 1913). (*Ed.*).

Plants first sown	Yield of first sowing	Yield of subsequent sowings										Average of subsequent sowings
		Oats	Maize	Millet	Flax	Buckwheat	Camelina	Hemp	Beets	Peas	Poppy	
Oats	100	84.1	—	52.5	—	130.0	—	107.9	138.4	91.4	—	—
Maize	100	—	68.5	—	—	—	—	—	—	—	94.3	81.4
Millet	100	—	—	21.1	—	—	—	—	—	—	39.1	30.1
Flax	100	—	38.4	—	44.0	—	31.6	—	51.8	89.3	—	51.0
Buckwheat	100	98.1	—	—	—	81.2	—	125.6	—	—	82.8	87.4
Camelina	100	—	—	—	44.9	—	17.8	—	—	—	—	29.9
Hemp	100	—	—	—	—	—	—	103.7	—	—	—	103.7
Beets	100	—	86.9	—	—	—	—	—	93.2	—	—	90.0
Peas	100	—	—	79.2	—	99.0	87.8	—	—	80.4	—	86.6
Poppy	100	—	—	—	—	—	—	—	—	—	—	—

sown and gathered after six weeks; the ground was then turned over and the superficial part was sifted, after which it was again sown. This second sowing developed badly, yielding a lighter crop. The application of complete manuring made practically no change in these abnormal results. Summarizing:

1. — In making two successive cultures in the same pot it was observed that the second yielded a markedly inferior crop and showed abnormal development.

2. — The application of complete manuring had an insignificant action on this abnormality.

3. — The abnormal development of the second culture is evidently to be attributed to injurious substances which have been formed during the first culture, as the alkalinity observed in the soil cannot be the only cause.

In a last series of experiments the writer cultivated three plants of oats or buckwheat suspended on nets in glass vessels of the capacity of 2 litres. The vessels were filled with a solution or watery extract of soil obtained by lixiviativg 3 kg. (6.6 lbs.) of dry earth with 3 litres of water; in one set of pots the solution was boiled, in another it was filtered through charcoal, and in a third it was used as it was; to every pot Hellriegel's mixture was added. The solution of most of the soils showed toxic properties causing abnormal development and a sickly appearance. The plants developed quite normally in the pots containing the solutions filtered through charcoal; they behaved variously in those containing the boiled solution, developing sometimes normally, at other times abnormally. In the solutions of soil which had not been previously sown to cereals, the development was normal.

Summarizing :

1. — The solutions of sick soils contain substances injurious to plants which may be eliminated by filtering through charcoal.

2. — Boiling only eliminates these injurious substances from some soils.

3. — The solutions of soils not previously sown to cereals do not contain injurious substances.

4. — It does not appear that the soil solutions exert a noxious action for only one plant, but on vegetative development in general ; it is no question of specific or toxic action upon certain species or genera.

15 – **Enrichment of Farmyard Manure by Cake Feeding.** – HALL, A. D. in *The Journal of the Board of Agriculture*, Vol. XX, No. 8, pp. 665-672. London, Nov. 1913. MANURES AND MANURING.

Whilst a Hertfordshire land similar to that on which the Rothamsted experiments are conducted yielded formerly a crop of about 20 bushels of wheat per acre under the old four-course rotation, the introduction of new sources of fertility during the last seventy years has raised the production to something over 30 bushels per acre. This extra fertility is usually obtained by the English farmer from two sources : 1) artificial manures, like guano and nitrate of soda ; or 2) imported feeding stuffs, like linseed, cotton cake and maize.

Which source is the cheaper is not a question capable of any general answer, but the English farmer has usually preferred the feeding stuffs, partly because he has imagined that he got a double benefit out of the cake, etc., first as food, then as manure, and partly because he has known more about farmyard manure than about artificial fertilizers.

In an exact consideration of the question, it is, however, necessary to distinguish the two-fold actions 1) of the feeding stuffs as food and as manure, 2) of farmyard manure as fertiliser and as an ameliorator of the soil because of the humus it contributes.

It is now generally accepted that at the most one-half of the nitrogeu contained in a feeding stuff reaches the land again in the dung. The point requiring most investigation is the amount and nature of the fertility added by cake feeding after allowing for the loss of about 50 per cent. of the nitrogen in the food. With this object in view, experiments were instituted at Rothamsted in 1904 on the relative crop-producing powers of equal weights of dung made with and without cake, in the year of their application and in the three subsequent years.

In a field containing eight series, two series of five plots each were arranged as follows :

	1	2	3	4	5	
4	No manure	1904 1908	1905 1909	1906 1910	1907 1911	Ordinary dung
8	1904 1908	No manure	1905 1909	1906 1910	1907 1911	Cake-fed dung

In each series there is a check plot which remains unmanured; the manure was applied each year to one plot only, the application of manure being renewed at the end of four years and so on. To obtain the dung for comparison, two sets of bullocks were set apart each year, one getting roots and hay only, the other the same plus 4 to 8 lbs. of cake or other concentrated food. The dung made was carted straight out to the land, or was made up into a heap for a month or so, and then well mixed; equal weights were put on the plots at the rate of 16 tons to the acre.

The chemical analyses of the two kinds of dung have given the following average composition:

Manure	Dry Matter	Nitrogen			
		Total	As ammonia	As amides, etc., soluble	Insoluble
From roots and hay only . . .	2.64	0.530	0.043	0.069	0.418
From roots and hay with cake.	2.66	0.701	0.147	0.118	0.436

It will be seen that as regards the insoluble compounds of nitrogen the two kinds of dung are much alike, but the cake-fed dung contans on the average more than double the amount of ammonia and amides.

The rotation adopted was alternating roots and corn: swedes, barley, mangolds, wheat. The results of nine years' experiments compared with the yield of the unmanured plot taken as 100 were the following:

Manure	Yield: total produce (unmanured plot = 100)			
	Year of application	Second year	Third year	Fourth year
	Mean of 9	Mean of 8	Mean of 7	Mean of 6
Dung from roots and hay only	134	123	114	106
Dung from roots and hay with cake	165	132	113	108

The principal conclusion which may be drawn from these experiments is that the extra value conferred upon dung by cake feeding is not of an enduring nature; the first crop gets most of the benefit, giving twice the increase of that getting common dung; in the second crop the ordinary

dung has given an increase of one-quarter, the cake-fed dung of one-third, while in the third and fourth years there is no difference.

It is evident that compensation for cake feeding should not be carried back for more than two years prior to the end of a tenancy.

These results suggest that on light arable land, where dung is of great importance and where (in England at present) bullock-feeding is unprofitable, the farmer will do better to feed his bullocks without cake, except such as is required to finish them off in the last month or so. In this way he may save £10 on the cake per acre of root land, while the nitrogen can be made up for 20 to 30 *s* by a dressing of sulphate of ammonia or other nitrogenous fertilizers ; this method has the additional advantage that the extra nitrogen can be applied to whatever crop will best repay its use, instead of being necessarily applied in the dung to the roots.

The writer concludes that other experiments are desirable, experiments that involve, as those of the future are all likely to do, systematic account keeping as well as a record of yields, because there is a practical issue at stake which would affect the practice of many of the best farmers in the country, many of whom, the writer believes, are persisting in a method of obtaining fertility that once was good, but has now become unprofitable at current prices for feeding stuffs and store cattle.

16 – **On the Decrease of Available Phosphoric Acid in Mixed Fertilizers containing Acid Phosphate and Calcium Cyanamide.** — BRACKETT, R. N. (Chemical Department, Clemson Agricultural College, South Carolina) in *The Journal of Industrial and Engineering Chemistry*, Vol 5, No. 11, pp. 933-935. Easton, Pa., November 1913.

Complaints have been made by manufacturers on the disadvantages of using calcium cyanamide in the preparation of mixed fertilizers, especially in regard to the danger of diminishing the amount of assimilable phosphoric acid.

Laboratory experiments have shown that when cyanamide is mixed with superphosphate in the proportion of one part of the former to 6.25, 8.33, and even 9.8 parts of the latter, a gradual increase of insoluble phosphoric acid and consequently a decrease of the assimilable acid takes place ; and this both in the simple mixture of superphosphate and cyanamide as well as in the presence of organic nitrogenous manures and of salts of potash.

Experiments made on a large scale by three manufacturers have also demonstrated that a decrease of assimilable phosphoric acid takes place when cyanamide and superphosphate are used in the preparation of mixed fertilizers at the rate of one part of the former to 6.25 or 8.33 of the latter.

The same danger of diminishing the assimilability of the phosphoric acid in compound fertilizers, when they contain calcium cyanamide and superphosphate, was confirmed by the analyses made by the fertilizer control service.

On the whole the experiments show that the factor time has an important influence in determining the insolubility of phosphoric acid, and must be taken into consideration, together with the factors represented by the increase of temperature which occurs during the mixing and by the alkalinity of the cyanamide.

In conclusion, it appears from the above that mixing cyanamide with superphosphate, while not injurious from the farmer's or purchaser's point of view, to the resulting compound manure, still requires special attention on the part of the manufacturer and vendor as to the quantity of cyanamide used, lest the manure be found on inspection and analysis to be deficient in avaible phosphoric acid.

17 – **The Degree of Fineness of the Lime used for Dressing Land.** — MEYER, D. in *Illustrierte Landwirtschaftliche Zeitung*, Year 33, No. 84, p. 755. Berlin, October 18, 1913 (1).

It is now well known that the degree of fineness of the ground limestone used as a dressing has a notable influence on its efficiency. Nevertheless there is no uniform understanding on the subject and consequently the commercial products do not present the same degree of fineness. Thus ten samples of ground limestone and two of calcareous mar taken as commercial samples by the Halle a. S. Experiment Station gave the results shown in the accompanying table.

No. of origin	Name	Degree of fineness					
		> 5 mm.	> 2 mm.	> 1 mm.	> 0.5 mm. (sieve No. 5) (*)	> 0.2 mm. (sieve No 100 for basic slag) (*)	> 0.2 mm. (fine particles)
1	Ground limestone	0.80	1.55	9.63	23.38	13.17	51.47
2	,, ...	4.12	5.45	17.66	23.12	12.10	37.55
3	,, ...	0.00	0.00	0.20	14.76	22.04	63.00
4	,, ...	0.00	0.15	17.95	28.63	13.26	40.01
5	,, ...	0.00	0.00	7.78	21.24	14.88	56.10
6	,, ...	0.00	0.00	0.00	4.05	21.41	74.54
7	,, ...	0.00	2.15	9.24	21.79	20.32	46.50
8	,, ...	0.00	0.00	0.00	0.32	9.66	90.02
9	,, ...	0.00	0.00	0.16	0.43	4.38	95.03
10	,, ...	0.00	0.00	1.11	26.52	17.48	54.89
11	Very soft calcareous marl	0.00	0.27	23.17	26.16	15.80	34.60
12	Fairly hard dº	0.80	9.30	13.90	22.81	14.24	38.95

(1) In wire sieves the mesh width is given by the diagonal.

(1) See also *Landw. Wochenschrift für die Provinz Sachsen*, Year 15, No. 43, pp. 355-356. Halle a. S., October 25, 1913. (*Ed.*).

The majority of these limestones have an insufficient degree of fineness, and it would be desiderable that the marls should be ground.

The writer accordingly proposes :

1. *a*) The content of fine meal (that passes through sieve No. 100 for basic slag) of the limestones and of the calcareous marls should be at least 70 per cent.

b) The portion remaining on sieve No. 100, but passing through sieve No. 50 should not be higher than 75 per cent. of the amount paid for as lime, and the proportion that passes through a sieve with 1 mm. round holes must not exceed from 25 to 50 per cent. of the above amount.

c) The portion above 1 mm. should be deducted.

2. It would be desirable that moist calcareous marls and limestones for meadows should be dried and if necessary ground before being used.

3. The various forms of lime must bear their proper designation: thus, for instance, ground limestone must not be sold under the name of calcareous marl.

Burnt lime is commonly used in lumps or ground. Lately so-called " Körnerkalk " has been put on the market ; it is in pieces the size of peas or hazelnuts and is very convenient for spreading. The writer, however, believes that owing to the difficulty with which the pieces break up, it is advisable, when burnt lime cannot be applied in any other form, to use ground limestone instead of " Körnerkalk ".

18 – **Sulphur and Pyrites used as Manure.** — VERMOREL, V. and DANTHONY, E. in *Journal d'Agriculture pratique*, New Series, Vol. 26, No. 47, pp. 651-653. Paris, November 20, 1913.

This article reports new experiments on the possible fertilizing action of sulphur, carried out in paraffin-wire pots filled with a soil carefully deprived of organic matter.

In one series of experiments nitrogen was given under the form of nitrate of soda, in the other as dried blood ; the nitrogenous fertilizer was mixed with sulphur, and applied to the surface or mixed with the earth; the same was done with the controls without sulphur, all other conditions being equal. The results are shown in Table I (next page).

Summarizing: in the nitric nitrogen series the action of sulphur is practically nil, the differences observed being within the range of experimental error ; on the other hand, in the organic nitrogen series considerable increases of yield have been observed, up to 30 per cent. with wheat and up to 60 per cent. with beans (haricots) when the larger quantity of sulphur was mixed with the soil. These results appear to confirm those obtained by Boullanger and Dujardin (1), namely that sulphur exerts little or no action without organic nitrogen, but acts energetically in the presence of organic matter.

In the same manner as with sulphur, Vaux pyrites containing 50 per cent. of sulphur were also tested, with the results shown in Table II.

(1) See No. 1397, *B.* Oct. 1912 (*Ed.*).

TABLE I.

Treatment	Weight of crop compared to that of control taken as 100			
	Manured with nitric nitrogen		Manured with organic nitrogen	
	Grain	Straw	Grain	Straw
Wheat				
Control	100	100	100	100
Sulphur as top dressing (of 44.6 lbs. per acre). . .	98	99	109	112
id. mixed with the soil (*id.* *id.*). . .	105	104	115	111
id. as top dressing (of 89.2 lbs. per acre). . .	102	103	121	111
id. mixed with the soil (*id.* *id.*). . .	104	104	130	162
Beans (haricots)				
Control	100	—	100	—
Sulphur as top dressing (of 44.6 lbs. per acre). . .	106	—	120	—
id. mixed with the soil (*id.* *id.*). . .	100	—	150	—
id. as top dressing (of 89.2 lbs. per acre). . .	96	—	130	—
id. mixed with the soil (*id.* *id.*). . .	98	—	160	—

TABLE II.

Treatment	Weight of crop compared to that of control taken as 100			
	Manured with nitric nitrogen		Manured with organic nitrogen	
	Grain	Straw	Grain	Straw
Wheat				
Control	100	100	100	100
Pyrites as top dressing (89.2 lbs. per acre). . .	102	102	129	130
id. mixed with soil (*id.* *id.*). . .	100	100	120	118
id. as top dressing (178.4 lbs. per acre). . .	100	101	120	111
id. mixed with soil (*id.* *id.*). . .	101	100	141	176
Beans (haricots)				
Control	100	—	100	—
Pyrites as top dressing (89.2 lbs per acre). . .	104	—	142	—
id. mixed with soil (*id.* *id.*). . .	103	—	140	—
id. as top dressing (178.4 lbs. per acre). . .	98	—	125	—
id. mixed with soil (*id.* *id.*). . .	104	—	152	—

As with sulphur, the action of pyrites on nitric nitrogen has been next to nothing, while with organic nitrogen the increases in yield have been as high as 40 per cent. with wheat and 50 per cent. with beans. Thus pyrites also has no effect except in the presence of organic matter.

The advantage of using pyrites (1) deserves to be confirmed by experiments on a large scale.

19 – **Research on Vegetable Physiology : II.** — MAZÉ, P. in *Annales de l'Institut Pasteur*, Vol. XXVII, No. 8, pp. 651-681. Paris, August 1913.

AGRICULTURAL BOTANY. CHEMISTRY AND PHYSIOLOGY OF PLANTS.

In the first part of this paper(2) the writer gave an account of his experimental methods for conducting water cultures under sterile conditions and concluded from his work on maize that plants have the power of excreting residual substances both through their roots and through their leaves In the present paper he adopted the same methods of water cultures, and, still working with maize, he examined the storage of mineral matter in the various plant organs.

His original food solution was made up as follows :

	gms.
Sodium nitrate	0.6617
Ammonium sulphate	0.514
Potassium phosphate (neutral)	1.0
Magnesium sulphate + 7 Aq	0.2
Ferrous sulphate + 7 Aq.	0.1
Zinc chloride	0.05
Potassium silicate	0.05
Manganese chloride.	0.05
Calcium carbonate	2.0
Tap water	1000

This he calls P×1, and others in which the nitrogen is provided by one single compound become P×1 Na NO_3, P×1 $(NH_4)_2 SO_4$, P×1 $NH_4 NO_3$, etc.

Twenty plants were grown in solutions of various strengths and with their nitrogen supplied under different forms ; their ash content was estimated in the various plant organs (Table I). The ash content of the leaves varied little with regard to both the age of the plants and the strength and composition of the solutions employed, while that of the stems and roots reflected more markedly differences of age and of food supply. The total ash content of the plants in the solutions in which the nitrogen was provided in the form of sodium nitrate was higher than that of those in which the nitrogen was provided in the form of ammonium sulphate or ammonium nitrate.

(1) See No. 918, *B.* Aug. 1913 (*Ed.*).
(2) See No. 3108, *B* Nov.-Dec. 1911. (*Ed.*).

TABLE I.

No. of plant	Culture solution	Age of plant	Dry weight	Ash per 100 dry matter		
				Stems	Leaves	Roots
		days	gms.			
1	P × ¼	25	2.975	12.31	12.83	—
2		31	4.330	10.75	11.65	14.73
3		45	9.480	7.79	7.90	10.39
4		53	8.560	8.57	8.54	8.70
5	P × ½	25	2.12	16.24	11.11	—
6		31	3.21	17.23	12.62	—
7		45	13.32	17.35	10.12	13.11
8		53	14.38	11.60	11.77	12.38
9	P × 1 $NaNO_3$	25	1.875	20.06	14.40	—
10		31	2.10	18.50	14.66	—
11		45	13.73	20.24	12.00	21.18
12		53	9.39	18.84	12.03	16.10
13	P × 1 NH_4NO_3	25	1.07	15.35	13.95	—
14		31	2.01	13.82	13.46	—
15		45	17.29	22.73	11.83	14.04
16		53	8.07	15.65	12.14	13.75
17	P × 1 $(NH_4)_2SO_4$	—	10.975	18.97	11.76	12.68
18		—	8.630	15.81	11.58	12.92
19	P × ½ $(NH_4)_2SO_4$	—	10.665	13.81	11.64	7.81
20		—	8.26	9.63	11.20	14.53

In a further set of experiments 6 plants, after being developed in a complete food solution, were transferred to incomplete solutions for a certain length of time and then analysed for ash content. Here again there was an attempt to keep the ash content of the leaves constant and approximately the same as in the previous experiment, but this was done at the expense of the stems and roots, which were seriously depleted.

After removal of all plants for analysis, the solutions remaining in the jars were measured and tested for acid or alkaline reaction. The writer discusses the changes undergone by the solutions during the growth of the

plant, and looks upon the results as confirming his previous work on the exosmosis of roots.

Absorption of complex organic substances by maize roots. — Nine plants were raised in various complete food solutions which were later replaced by solutions containing complex organic substances. (Table II).

TABLE II.

No. of plant	Complete food solution	Organic solution	Containing organic matter per litre	No. of days in org. solution	Org. matter absorbed by the plant	Dry weight of plant
			gms		gms.	gms.
1	P × 1 NH_4 Cl	Starch paste . . .	4.492	43	7.694	41.34
2	P × 1 NH_4 Cl	Peptone Chapoteaut	3.842	43	2.926	33.01
3	P × ½ NH_4 Cl	Peptone + NH_4NO_3 0.5 p. 1000 . . .	3.829	43	6.488	48.41
4	P × 1 $(NH_4)_2SO_4$	Humus + $NaNO_3$ 0.5 p. 1000 . . .	0.866	41	2.035	—
5	P × ½ $(NH_4)_2SO_4$	Humus + potassium phosphate 0.5p. 1000	0.682	41	1.626	30.76
6	P × ½ NH_4 Cl	Distilled water . .	—	54	—	28.80
7	P × ½ $(NH_4)_2SO_4$	» » . .	—	52	—	26.95
8	P × ½ NH_4 Cl	Saccharose	50	25	26.843	40.41
9	P × ½ $(NH_4)_2SO_4$	»	20	25	17.568	31.70

At the end of the experiment the organic matter remaining in the solution was estimated, and from that the amount absorbed by the plant was calculated. All plants in the organic solutions produced more dry weight than those in distilled water. Those in the sugar and peptone solutions presented a peculiar appearance : the leaves of the former assumed an upright position, and the sheaths rolled up as if to avoid the light; on the other hand the leaves of the peptone plants lost their turgescence and elasticity, and hung down along the stems. The roots of these same peptone plants ramified abundantly, and developed more especially in the air space above the level of the solution in the flask, the extremities dipping into the solution 2 or 3 cm. and following the level down gradually as the solution evaporated. The ash content of the 9 plants showed, with two exceptions, the same characteristics as that of the plants in previous experiments : *i. e.* the percentage in the leaves remained high and fairly constant at the expense of the

roots and stems. The two exceptions were the plants fed on sugar and peptone discussed above, in which the normal functions of the plant were evidently interfered with.

The Law of the Minimum and the Law of Physiological Relationship. — Returning to the 2nd set of experiments, it may be remarked that the 5 plants in the incomplete solutions did not make as much growth as the one in distilled water. The writer points out that incomplete solutions must therefore have a retarding action and suggests as an explanatory hypothesis his Law of Physiological Relationships, which supposes that for each plant there exists a certain combination of the nutrient elements which gives optimum results and that any disturbance of this balance produces ill effects on the plant. To test this hypothesis further a food solution was made up having a strength A, and with it 5 culture solutions were prepared:

1. A $\times \frac{1}{4}$
2. A $\times \frac{1}{4}$ + the potassium phosphate contained in A $\times$ 1.
3. A $\times$ 1
4. A $\times$ 1 » » » A $\times$ 1.5.
5. A $\times$ 1.5.

The resulting plants are shown in a photograph, where 3 is distinctly the largest, followed by 1 and 5, while 2 and 4 are evidently suffering from the effects of some inhibiting factor. The Law of the Minimum, according to which growth is limited by the amount of one particular element which may happen to be deficient, fails entirely to account for these results, while the Law of Physiological Relationships affords a more satisfactory explanation of facts. The writer continued his researches on the subject, using *Aspergillus niger* and Raulin's solution of various strengths in which the nitrogen supply was thrown out of balance and increased to 16 or 32 times the normal amount. In every case the fungus made less growth on the unbalanced solution than on the balanced solution, whether the latter were weak or strong. Similar results, however, were not obtained when potassium phosphate was added in excess instead of nitrogen.

20 – **The Water Requirement of Plants in the Great Plains.** — BRIGGS, LYMAN J. and SHANTZ, H. L. — *U. S. Department of Agriculture, Bureau of Plant Industry, Bulletin* No. 284, pp. 7-48, plates I-XI. Washington, D. C., October 1913.

This investigation was carried out to determine the differences in water requirement of the more important crop plants and some of their varieties, with a view to determining the most suitable plants for the semi-arid conditions of the Great Plains. The water requirement of a plant, or its transpiration ratio, is obtained by dividing the weight of total water absorbed by the total dry weight of the plant or by the weight of grain. Its value varies with changes in the temperature and humidity of the air, velocity of wind, intensity of solar radiation and fertility of the soil. In order to control these factors the experiments were carried out in a

screened enclosure with a capacity for 200 pots arranged in 5 rows running east and west. The walls of the enclosure to a height of 3ft. consisted of tight boards. A strip of thin cheese cloth 3ft. wide, supported on both sides by wire netting, was placed immediately above the boards. This did not interfere with the ventilation of the enclosure, but it served to break the force of high winds. Measurements with a silver disc pyrheliometer showed that the reduction in the direct radiation of the sun due to this screen amounted to about 26 per cent. at 10-30 a. m. Experiments with tumble weeds (*Amaranthus graecizans*) inside and outside the enclosure showed that the difference in water requirement between the two series was less than the probable error of observation. Later experiments, however, with more succulent plants like wheat and alfalfa, have shown that the screening effect of such an enclosure reduces the water requirement in a measurable degree. Since the determination of the *relative* water requirement of the different crop plants is the main problem, it was considered necessary to eliminate such factors.

The pots were made of heavily galvanized corrugated iron, 40 cm. in diameter and 66 cm. high, and had a capacity of about 250 lbs. (115 kg.) of soil. Each pot was fitted with a heavy galvanised iron cover through which holes were punched suitable in size and number to accomodate the particular crop which it was desired to grow. The joint between the can and the cover was sealed with a strip of surgeons' adhesive plaster 2 inches wide. Care was taken to have the soil at the top of the plots built well up so as to be in firm contact with the cover. A special arrangement for supplying the necessary water was fitted into the centre of the cover, as it was found that supplying the water at the bottom of the vessel caused stagnation of the lower portion and increased the value of the transpiration ratio considerably.

The seeds, after germination, were planted through the openings in the cover of the pot and covered with light moist soil to the level of the cover. The exposed soil was then protected from evaporation by means of a layer of wax consisting of a mixture of 8 parts of pure beeswax and 2 parts of tallow. The seal was thickened as the plants became established. This method of preventing evaporation and excluding rain proved most satisfactory, especially with small grains.

The daily weighings were made upon a spring balance reading to 0.1 kg. The balance was checked frequently by means of a standard weight kept for the purpose. The plants were cut at the stage when similar crops were harvested in the field, and the cropping was weighed green and after drying to constant weight at 110° C.

Each pot was weighed soon after the seeds were planted and again immediately after the crop was harvested. The weight of water supplied during the experiment minus the difference between the final and initial weighings gives the total weight of water absorbed by the plant. This method of calculation is subject to two errors, which balance each other to some extent, *viz.* a value too high by the amount of the dry weight of the tops and a value too low by an amount equal to the green weight of the roots. The

TABLE I. — *Based on dry matter produced.*

Crop	Variety	Water requirement		
		of variety	of species	Relative compared with wheat = 100
Alfalfa (lucerne) .	Grimm	1068±16	1068	211
Pea, field	Canada	800±17	800	158
Artemisia frigida .		765 ±24	765	151
Rye.	Spring	724±7	724	143
Sweet clover (melilot)		709±9	709	140
Oats	Burt	639±7	614	122
	Swedish Select	615±7		
	Sixty-Day	605±5		
	Canadian	598±14		
Buckwheat. . . .		578±13	578	114
Barley.	Beardless	544±9	539	106
	Beldi	543±2		
	White Hull-less	542±3		
	Hannchen	527±8		
Wheat.	Emmer	534±14	507	100
	Marvel Bluestem	531±5		
	Spring Ghirka	506±3		
	Galgalos	496±4		
	Kubanka	468±8		
Potato	Irish Cobbler	448±11	448	88
Rape		441±12	441	87
Sugar Beet . . .	Kleinwanzleben	377±8	377	74
Corn (maize) . . .	Iowa Silvermine	426±3	369	73
	Northwestern Dent	368±10		
	Esperanza	319±5		
Weeds.	*Amaranthus retroflexus*	356±4	322	63
	Salsola pestifer	336±5		
	Amaranthus graecizans	275±7		
Sorghum.	Dwarf Milo	333 3	306	60
	White Durra	321±2		
	Brown Kaoliang	301±3		
	Red Amber	298±4		
	Blackhull Kafir	278±5		
Millet	Kursk	287 ±2	275	54
	German	263±15		

TABLE II. — *Based on grain produced.*

Crop	Variety	Water requirement		
		of variety	of species	relative, compared with wheat = 100
Pea, field	Canada	2218±100	2218	163
Rye	Spring	2215±37	2215	163
Oats	Canadian	2204±140	1680	124
	Sweedish Select	1632±35		
	Burt	1500±57		
	Sixty-Day	1383±30		
	Marvel Bluestem	1786±60		
	Spring Ghirka	1382±43		
Wheat	Galgalos	1245±13	1357	100
	Kubanka	1191±14		
	Emmer	1180±42		
Barley	White Hull-less	1475±40	1244	
	Beardless	1210±38		
	Beldi	1155±18		
	Hannchen	1134±27		
Buckwheat		1037±33	1037	76
Millet	Kursk	923±40	923	68
Sorghum	Dwarf Milo	1123±57	790	58
	White Durra	806±12		
	Blackhull Kafir	803±26		
	Brown Kaoliang	726±12		

water requirement of each pot is determined separately and the mean of six determinations is taken to represent the water requirement of the plant under investigation. This procedure also afforded a basis for calculating the probable error of the mean determination.

The results of the experiments with various crops are summarised in Tables I and II.

These results show that field crops differ considerably as regards their efficiency in the use of water. Alfalfa (lucerne) for example uses four times as much water as millet and sorghum in the production of a pound of dry matter. Corn (maize) ranks next to sorghum and millet in efficiency. The water requirement of the small grain crops is approximately twice that of millet, but only half that of alfalfa.

Varieties of the same crop also show measurable differences in their

water requirement, suggesting the possibility of developing strains of greater efficiency and more suitable to arid soils than those now grown.

The water requirements of the different weeds gave unexpected results. *Artemisia frigida* (mountain sage) is a native plant, and, being covered with a dense silvery pubescence, from a morphological point of view it would appear to be admirably adapted to a dry country. Its water requirement, however, is 765 ± 24 and as the plant grows very slowly it has a very low degree of efficiency in the use of water. There would appear to be little connexion between the morphology, degree of succulence and the water requirements of a plant.

Determinations of the water requirements of wheat were made under field conditions by means of an extensive series of soil sampling carried out daily throughout the experiments. The rainfall absorbed by the soil was computed from the daily moisture determination. The water requirements of Kubanka wheat obtained in this were 700 and 862 for the seasons 1910 and 1911 respectively, while figures obtained in the pot experiment were only 468. If, however, we deduct the amount of rainwater absorbed by the soil from the above determination, the amount of stored water removed by the wheat in the open field becomes 486 and 466 for the two years, results which agree with the pot determinations. This shows that wheat is able to make little direct use of light rains during a dry season when the roots are obtaining their matter from the lower depths.

Experiments with wheat and sorghum at Akron (Colorado) and at Amarillo and Dalhart in North Texas also gave interesting results. The evaporation from a free water surface in North Texas during the growing season of wheat was 18 per cent. higher than that at Akron. The water requirement of sorghum was practically the same in the two regions (356 and 359), while the water requirement of wheat averaged 36 per cent. higher in North Texas. Thus sorghum is relatively better adapted to Texas and wheat is relatively better adapted to Colorado.

21 – **The Occurrence of Aluminium in Plants.** — KRATZMANN, E. (Pflanzenphysiologischen Institut der K. K. Universität in Wien) in *Sitzungsberichte der K. Akademie der Wissenschaften, math.-naturwiss. Klasse*, Vol. CXXII, Part II, No. 1, pp. 311-336 + figs. 6. Vienna, 1913.

The writer first tested the various methods for the micro-chemical determination of aluminium, observing that for the researches on plants the element is to be determined as double sulphate of aluminium and caesium; the sensibility of the reaction is 0.3 μ gm. Following this method, 130 plants belonging to various families were tested for aluminium. The results showed that this element is widely spread in the vegetable kingdom, and that some plants are so rich in aluminium that they may be called "aluminiphilous". Nevertheless the presence of aluminium in plants is not connected with their taxonomic position; there are remarkable differences in the same genus and also individual deviations. In several cryptogams, aluminium concentrates in the fertile tissues, and also among angiosperms it often accumulates in the flowers. Lastly, it appears that plants

possess a specific elective power towards aluminium, for of two plants of different species grown quite close to each other on the same soil, one may accumulate much aluminium and the other none.

22 – **A Study of the Methods of Estimation of Carbohydrates, especially in Plant Extracts.** — DAVIS, W. A. and DAISH, A. J. (Rothamsted Experimental Station) in *Journal of Agricultural Science*, Vol. V, Part 4, pp. 437-468. Cambridge, October 1913.

During an investigation of the carbohydrates present in the mangold leaf now in progress, the writers made a special study of the methods of analysis applicable in such cases. They detected certain errors which are likely to occur in this class of work and describe a new method for the estimation of maltose in presence of other sugars.

23 – **Analysis of Willow Ashes.** (Bericht über die Tätigkeit der landw. Kreisversuchsstation für Mittelfranken in Friesdorf für das Jahr 1912, Year IV). — KLEEMANN in *Landwirtschaftliches Jahrbuch für Bayern*, Year 3, No. 11, pp. 622-628. Munich, 1913.

With the object of determining the basis of a possible manuring for willows, complete analyses of the ash of various parts of two kinds of willow were made, besides determinations of the nitrogen content. These data were hitherto lacking in the literature on the subject.

Percentage to dry matter.

	Part	Nitrogen	Ash	Silica	Phosph. pentoxide	Chlorine	Sulphuric anhydride	Carbon dioxide	Ferric oxide and alumina	Lime	Magnesia	Potash	Soda
Salix viminalis (gathered in the middle of September)	Leaves	2.59	7.93	0.71	0.12	0.13	0.82	1.22	0.08	2.41	0.97	1.22	0.15
	Bark	1.31	3.61	0.05	0.04	0.01	0.18	0.82	0.04	1.24	0.34	0.87	—
	Wood	0.42	1.04	0.04	0.06	0.01	0.04	0.21	0.02	0.29	0.14	0.37	—
Salix amygdalina (gathered in the middle of September)	Leaves	2.73	6.08	0.40	0.06	0.12	1.02	0.07	0.07	1.04	0.74	1.72	0.05
	Bark	1.37	3.38	0.05	0.03	0.01	0.15	0.02	0.02	0.93	0.33	0.94	—
	Wood	0.39	1.07	0.03	0.04	0.01	0.05	0.02	0.02	0.20	0.10	0.36	—

24 – **The Stomatal Characteristics of Sugar Cane.** — DUNLOP, W. R. in *West Indian Bulletin of the Imperial Department of Agriculture for the West Indies*, Vol. XIII, No. 4, pp. 314-323, + plates I-II. Barbados, September 1913.

A large number of different varieties of sugar cane were examined under field conditions with regard to those characters of the leaves affecting the rate of transpiration, *viz.* manner of curling, motor cells and woody tissue, frequency and size of stomata, etc.

The following conclusions were arrived at :

a) The morphological and anatomical characteristics of the leaves of each variety are so definite as to provide a ready means of identification.

b) Stomatal density per unit area is one of the chief characteristics, but does not appear to be correlated with other leaf characters such as size

of leaf, size of individual stomata, and total area of foliage, though small stomata are often numerous and *vice versa*.

c) There appears to be some correlation between susceptibility to drought and the ratio of the total stomatal area to the total area of foliage, but this point requires further investigation.

d) The manner of curling is probably more important in limiting the effective action of the stomata than the stomata themselves. It is correlated with the ratio between the stomatal densities of the two leaf surfaces, with the anatomical structure (motor cells and woody tissue) and with the erect position of the leaf. This correlation between leaf habit and stomatal charateristics appears to affect the distribution of varieties in cultivation.

e) The greatest stomatal area was associated with a very high sugar content.

The writer suggests that more attention should be paid to the habit and stomatal characteristics of the leaf in selection for drought resistance in sugar cane.

PLANT BREEDING.

25 – On the Importance of the Structure of the Ear in the Selection of Maize. — FLEISCHMANN, REZSÓ in *Köztelek*, Year 23, No. 89, pp. 3012-3013. Budapest, November 15, 1913.

In selecting the ears of maize, growers as a rule only take into consideration the pure line and the percentage of cob and grain in relation to the whole ear. There are, however, certain other essential characters which should not be lost sight of. One is the number of rows, which may vary from 8 to 26 or even more in the case of the Horsetooth variety.

The importance of this character is demonstrated by observation on specimens of the above-mentioned variety, selected on the Ruma (1) estate; these showed that the weight of grain per ear increases regularly with the increase in the number of rows from 8 to 22.

The result of selection in increasing the number of rows in the crop is shown in Table I.

TABLE I.

Year	Parents	Number of rows of grain in offspring											Average number of rows of grain in all the ears
		8	10	12	14	16	18	20	22	24	26		
1909	Original plants selected in the field	0.7	5.2	39.8	41.2	10.8	2.0	0.3	—	—	—	—	13.0
1910	Line No 127 (16 rows) . .	—	—	7.8	29.0	38.2	17.2	5.5	—	—	1.5	0.8	15.9
1911	127/1910 (16 rows).	—	—	6.0	47.8	29.8	11.9	4.5	—	—	—	—	15.2
1912	127/1911 (18 rows).	—	—	7.1	17.9	34.6	32.2	5.9	2.3	—	—	—	16.4

(1) See No. 928, *B.* Aug. 1913. (*Ed.*).

The result was that the ears of 1912 had an average of 3 or 4 rows more than the original material of the first year.

In the number of seed-rows of the ears selected on the Ruma estate, the average of the ancestors varies about the figure 14, and the experimental data relating to the 1912 harvest indicated in Table II show that the offspring revert to this mean.

TABLE II.

No. of lines	No. of rows of grain in parents	Average No. of rows of grain in the ear of each generation
Plot No. I:		
13	14	14.04
20	16	14.58
5	18	15.56
2	20	16.23
1	22	17,31
Plot No. II:		
1	12	13.40
9	14	14.21
34	16	14.78
4	18	15.29
1	22	15.94
1	26	17.25
Plot No. III:		
7	12	13.92
24	16	15.01
6	18	15.32
8	20	15.88

According to these data the average number of rows of seeds in the offspring of the many-rowed parent ear is greater than the average of those from the fewer-rowed parent ears, but the average of the first approaches more nearly the average number of rows of the whole group (*i. e.* 14) than the number of rows in the parent ear. This character can only be fixed by prolonged and continued selection.

The results obtained in the pedigree selection on the Ruma estate during five years show that there is in the majority of cases a correlation between productivity and the number of seed-rows, as shown in Table III, in which the original plants of 1912 are divided into three groups according to the number of rows of their descendants of the first generation.

TABLE III.

Plot	No. of rows of parents		
	14	14-15	more than 15
	kg.	kg.	kg.
I (43 ears)	8.16	8.50	8.85
II (34 ears)	6.15	6.33	6.48
III (40 ears)	6.89	7.50	7.10

The ears of the high-cropping types had, except in certain cases, the greatest number of seed-rows.

The number of seed rows in the ear is also correlated with other characters. With increase in the number of rows the tips of the seeds are narrowed and become elongated, while the percentage of rachis in the ear decreases. The following results were obtained by the writer:

No. of rows	8	10	12	14	16	18	20
Percentage of rachis in the ear	20.6	16.7	14.4	14.3	15.4	15.3	14.9

These observations show that in the selection of maize or the improvement of the yield considerable importance should be attached to the number of seed-rows. At the same time the other characters must not be lost sight of. Further, the quantity and quality of the seeds, and the structure of the seeds, and the structure of the rachis are also important factors in the analysis, a thickened rachis being correlated with a low yield. Also a thick rachis contains more pith, which takes longer to dry and deteriorates quicker, especially during a wet season. The heredity of this character is shown in the following table:

Percentage weight of rachis in selected types at Ruma.

Type No.	181	288	127	204
1909 - Parent ears	8.9	11.0	15.9	17.1
1910 - 1st generation	11.7	10.4	14.4	15.3
1911 - 2nd »	13.2	13.3	14.7	16.3

ROOT CROPS.

26 – ***Tacca umbrarum*, a Starch-producing Plant in Madagascar.** — FAUCHÈRE, A. in *Journal d'Agriculture tropicale*, Year 13, No. 148, pp. 310-317. Paris, October 1913.

Tacca umbrarum ("Tavolo") grows wild on the eastern slope and in the interior of Madagascar. It produces tubers the size of a fist and sometimes

even as large an ostrich's egg. The natives of some provinces use them as food, either cooked whole or as flour extracted by primitive methods.

The plant grows in soil of varying fertility. The fresh tubers yield about 30 per cent. of dry marketable flour. This plant will probably soon be cultivated and may become an important source of starch.

7 – The Oil Palm. — *Bulletin de l'Association des Planteurs de Caoutchouc*, Vol. V, No. 10, pp. 256-257. Antwerp, October 1913.

The oil-palm (*Elaeis Guineensis*) is the source of palmetto-oil and palm-oil. The former is used in the preparation of vegetable butter, for which there is an ever increasing demand. The latter is in request by soap-manufacturers, being the most suitable fat for their purpose. The price of palm-kernels, which 20 years ago was 8*s* to 10*s* per cwt., has now reached 24*s* to 26*s*.

The introduction of this African palm into Asia has given very encouraging results. Its growth is satisfactory and the yield and richness of the fruit are superior to those in Africa. Experiments show that one acre of these palm trees yields more than 2500 lbs. of palm-oil, producing a profit of £ 24 per acre. The cost of establishing and maintaining till bearing begins reaches £ 32 per acre. These trees come into bearing in four years.

In the province of Tamiang in Sumatra, preparation has been made for planting 7 500 acres per year.

8 – Gru-Gru Palm Kernels (*Acrocomia sclerocarpa*) in Trinidad. — *Department of Agriculture, Trinidad and Tobago, Bulletin*, Vol. XII, No. 74, pp. 137-138. October 1913.

The gru-gru nut is widely distributed throughout Trinidad, but not in sufficient abundance for the development of an export trade. It is used locally as a roasted nut. Analyses at the Imperial Institute gave the following results.

Kernels	per cent.
Moisture	6.1
Fat (yellowish white, crystalline)	57.0

Analysis of fat compared with palm-kernel oil.

	Gru-gru fat	Palm-kernel oil
Specific gravity	0.867	0.8731
Acid value (1)	1.3	—
Saponification value (2)	253.7	242.4 to 254.8
Iodine value, %	16.2	10.3 to 17.5
Hehner value	88.5	91.1
Insoluble fatty acids, %	88.1	—
Unsaponifiable matter, %	0.41	—
Volatile fatty acids, soluble (3)	5.7	5.0 to 6.8
» » insoluble	12.6	—

(1) Milligrams of potash per gm. of oil.
(2) Cubic centimetres of N/10 alkali required to neutralise acid from 5 gms. of oil.
(3) Reichert-Meissl-Wollny number.

These gru-gru kernels should realise about the same market price as oil-palm kernels (£23 per ton), and should find a ready market if offered in shipments of from 50 to 100 tons.

RUBBER, GUM AND RESIN PLANTS.

29 – **The Rubber Crisis.** — 1. TILMANT, J. in *Bulletin de l'Association des Planteurs de Caoutchouc*, Vol. V, No. 10, pp. 247-256. Antwerp, October 1913. — 2. ZIMMERMANN, E. in *Deutsche Tageszeitung*, No. 572, 2nd. Supplement. Berlin, November 10, 1913.

M. Tilmant summarises various views brought forward by journals, reviews and other authorities on the present rubber crisis and its possible solutions. Protection is of particular importance in its relation to wild rubber.

Brazil. — A reduction in price does not affect the production till the following year. The quantity harvested depends on the credit of the " aviadores " and the means which they possess of sending workmen into the forest. They have suffered considerably this year owing to the fall in prices, and it seems doubtful if they will be in a position to finance the usual number of workmen next year.

The following measures have been adopted for improving the situation: Reduction of export duties by half ; suppression of all duties and taxes on plantation rubber ; construction of railroad; to reduce cost of trasports; construction of refining stations, so that only first quality products are exported.

Belgian Congo. — The export duty of 1.75 francs per kilo (7 ½*d* per lb.) has been removed. It is hoped that recourse to bounties will be avoided by the following means : Reduction of freight charges by rail and sea ; more careful collection of the tax, which is at present too frequently evaded ; increasing the tax on underselling pedlars.

French Equatorial Africa. — Export duties have been lowered from 0.60 franc to 0.30 franc per kilo (2 ¼*d* to 1 ½*d* per lb.). Including the reduction on the cost of transport by the Belgian Congo railway and the steamship companies, the total reduction on rubber in the French possessions amounts to 0.70 franc per kilo (3 *d* per lb.).

German Colonies. — In *East Africa* the most important question is the organisation of labour. The period of indenture should be increased from one to three years, in order to reduce the loss of time and money to the coolies, the owners and the colony. According to Dr. Zimmermann, the cost of production can be lowered by increasing the output of the workers and the purity of the product. An expert coolie should easily harvest a quantity of latex equivalent to 900 grammes of washed rubber ; at a market price of 3.5 marks (1*s* 6*d* per lb.) this will give a profit of £30 per ton. The reduction granted by the steamship companies has lowered the freight from 90 marks (£4 10*s*) to 65 marks (£3 5*s*) per ton. The reductions by the railway companies amount to 50 per cent. Unfortunately the total reduction represents only about ½*d* per lb. *Kamerun* asks for the abolition of the export duty of 1 ¾*d* per lb.

30 – **A New Method of Tapping Manihot.** — *Der Pflanzer*, Year 9, No. 9, pp. 473-475. Daressalam, September 1913.

M. Migdalsky, director of the Prinz Heino Plantation, Morogoro, E. Africa, has discovered a method of diminishing the expense of tapping Manihot trees. Lewa's method of rolling into balls involves considerable hand-labour, and has been modified as follows: a piece of cloth about 28 inches long and 4 inches broad is soaked with a solution of vinegar and applied to the incision in the bark; the cloth is then drawn upwards in close contact with the tree. The latex adheres to the cloth and is coagulated in the form of a small pellicle, which is easily detached:

This method has distinct advantages.

1) Fewer incisions are required compared with the older method and the trees can be tapped more frequently.

2) The rubber is pure and can be cleaned by hand, one workman being able to clean 60 lbs. per day.

3) The operator does not require the same skill as with the older method.

4) The yield of the labour is considerably increased. Unskilled workmen have produced in one day the following quantities:

a) by the old method (in balls). . . . . 8 1/2 oz.

b) by the new method . . . . . 28 oz.

31 – **Tobacco in the French Colonies.** — PRUDHOMME, EM., in *L'Agronomie Coloniale*, Year 1, Nos. 1-4, pp. 1-7, 42-52, 68-75 and 104-111, + 3 maps and 2 plates. Paris, Juliy-October, 1913. VARIOUS CROPS.

In 1910 a "Permanent and Interministerial (Finances and Colonies) Commission on Colonial Tobaccos" was appointed to investigate methods of improving the cultivation of tobacco in the French colonies and to inform planters of the best methods available. This Commission came to the following decisions:

1) To undertake a detailed study of the different varieties of tobacco actually grown in the colonies.

2) To enable planters to obtain good seed and technical advice, and to purchase their produce on trial through the Ministry of Finance.

3) To train a qualified staff, by organizing at the Ecole Nationale Supérieure d'Agriculture Coloniale a complete scheme of instruction, theoretical and practical, on the cultivation and preparation of tobacco.

Present State of the production of tobacco in the colonies, according to the report of the Commission.

Dahomey. — This tobacco is characterised by perfect combustibility, fine texture and low nicotine content, generally less than 1 per cent. These qualities make it probable that Dahomey can produce large leaf tobacco. For native consumption the coarser American varieties might be tried, such as Black Virginia and Kentucky, as preferred by them.

Guinea. — In this colony the tobacco is consumed particularly as snuff and chewing twist. In Camayenne crops of tobacco of good quality have been produced suitable for the manufacture of French pipe tobaco. Yel-

low Orinoco Virginia has shown itself superior in its mildness and good combustibility.

Senegal. — The production in this colony is not sufficient for local consumption and large quantities are imported from America.

Equatorial Africa. — Tobacco is cultivated chiefly in the immediate neighbourhood of the villages of the Oubangui-Chari-Tchad and the Middle Congo ; in the latter district it gives rise to a considerable trade. Owing to its defective market condition, the French Administration will not accept it, although its combustibility is recognised as very satisfactory and its nicotine content is low, not exceeding 1.8 per cent.

Réunion. — This island already exports tobacco, but not to France. There is a commercial movement of considerable importance which produces about £ 16 000. The chief variety cultivated is Langue de Boeuf, which has stiff lanceolate leaves with fine veins and resistant tissue. It is grown chiefly as an intercrop with sugar-cane in alternate lines with about 3 500 plants per acre. In order to reduce the strength of the tobacco and increase the fineness of the leaf for European consumption, it seems desirable to adopt a closer system of planting.

The preparation in Réunion comprises the following processes: 1) desiccation, 2) picking and sorting, 3) rolling, 4) pressing 5) cutting. Picking consists in removing the midribs of the leaves. Rolling includes sorting into bundles of about 26 lbs. The rolls are then submitted to a strong pressure and tightly bound. The tobacco thus undergoes fermentation in small heaps.

Cultivation experiments carried out at the St Denis Botanic Gardens (Réunion) have shown that it is possible to obtain: 1) tobaccos (variety Szamoshat) possessing such fineness of texture and colour as to resemble well-known leaf tobaccos ; 2) cut tobaccos (especially Maryland) of average strength and without a characteristic taste ; unfortunately these tobaccos (except Maryland) smoke so badly as to be almost unusable.

The Commission considers that investigations should be carried out on improvements in combuibility.

32 – **Turkish Tobacco in the Cape Province.** — STELLA, L. M. in *The Agricultural Journal of the Union of South Africa,* Vol. VI, No. 4, pp. 617-636 + plates I.-LXIII. Pretoria, October 1913.

Since 1906 the government has conducted experiments on the cultivation of Turkish tobacco in the Cape Province. These experiments have been carried out on private farms in charge of an officer. The progress in the cultivation during the last seven years is shown in the following table

The low price of the last year's crop is attributed to the unmatured state of the tobacco, which, not being in a suitable form for storing, had to be sold rapidly to unwilling buyers. The local demand for this tobacco is estimated at about half a million pounds per annum, so that with improved methods of preparation and marketing, this industry has considerable possibilities of further development. With this object in view the "Western Tobacco Growers' Company, Ltd." was formed in July 1912, and a scheme of rules

Year	No. of farms on which experiments were carried out	Area	Yield	Average price per lb.
		acres	lbs.	*s* *d*
1906-1907	6	7 ½	3 000	1 6
1907-1908	12	25	13 000	1 11
1908-1909	14	70	16 000	2 0
1909-1910	18	113	56 000	2 1
1910-1911	24	250	140 000	2 1 ½
1911-1912	32	400	250 000	1 6 ½
1912-1913	42	525	—	—

and regulations were drafted. A warehouse has since been opened and the solution of the profitable marketing of Turkish tobacco appears to be in sight.

33 – **The Cultivation of the Rose Geranium and its Present and Future Economic Conditions.** – CHARABOT, EUG. and GATIN, C. L. in *Journal d'Agriculture Tropicale*, Year 13, No. 148, pp. 289-295. Paris, October 1913.

The writers wish to suggest the cultivation of the rose geranium (*Pelargonium odoratissimum*) to planters. They emphasise the effect of climatic and soil conditions on the quantity and quality of the essence. Small trials should be made at first and the cultivation only continued in those places where it gives perfect results.

34 – **Note on a Lemon-Grass from Fiji.** — KNOWLES, C. H. *Department of Agriculture, Fiji, Bulletin* No. 6, pp. 4. Suva, 1913.

The writer gives the results obtained at the Nasinu Experiment Station with a lemon-grass (*Cymbopogon coloratus* Stapf.), introduced in 1907 from India. The most favourable time for harvest is when the plant has reached 3 or 4 feet in height before the flowering period is advanced. The percentage of oil in the young plants is greater than that of the old ones, but the total yield obtained is less. Thus a plot cut four times produced only one-third of the quantity of oil obtained during the same time from a similar plot cut only once after reaching 4 feet in height. The estimated yield of oil is 43 lbs. per acre per cutting.

Distillation experiments show that the process should not continue longer than 4 hours, because the amount of essence produced after this time is unprofitable. The profits per acre should reach £2 per cutting, and two or three harvests are obtainable in the year.

35 – **A Perfume Plant from West Africa: *Popowia Capea.*** — *Bulletin scientifique et industriel de la maison Roure-Bertrand Fils de Grasse*, 3rd Series, No. 8, pp. 3-17 + 4 plates. Grasse, October 1913.

Popowia Capea, or "capé", is a shrub belonging to the Anonaceae. The natives of the Ivory Coast crush it into cold water to perfume their baths. The dried stems and leaves are sold at about 1 franc the kilo (4 ½ *d* per lb.) M. and Mlle. Camus have made a complete botanical study of the species, which is given in the Roure-Bertrand bulletin (1).

The dried leaves give 59 per cent. of oil ; of this, 35 per cent. is heavier than water, and the rest lighter ; the first part may be called the heavy portion and the second the light portion. The accompanying table gives the analysis.

	Complete Essence	Heavy portion	Light portion
Specific gravity at 20°	1.00416	1.00808	0.99596
Polarimetric deviation	+ 76° 56'	+ 90° 54'	+ 51° 26'
Solubility in 80% alcohol	1 vol. then cloudy	1 vol. then very cloudy	1 vol. then very cloudy
Solubility in 95% alcohol	0.5 vol., then very slightly opalescent.	1 vol., from 3 vols. marked opalescence	0.5 vol., then very slightly opalescent.
Index of acidity	2.8	1.5	3.7
Saponification value	166.1	192.3	123.2
Saponification value of acetylated essence	239.9	248.3	218.4

This essence is thus especially distinguished by its high density, its high dextro-rotary power and the high proportion of saponifiable matter.

36 – **On the Anatomy of the Seed of *Abrus precatorius*** ("Jequirity") **and of the Seeds Used to Adulterate it.** — BARIOLA, ROSA in *Atti dell'Istituto Botanico dell'Università di Pavia*, 2nd Series, Vol. XVI, pp. 16, plates I-V. Pavia, 1913.

The writer, following up the preliminary note published at the end of 1912 (2), discusses at length the morphology and anatomy of the seed of *Abrus precatorius* ("Jequirity") and of the seeds of other Leguminosae (*Rhynchosia precatoria* =*R. phaseoloides* DC., *Adenanthera pavonina* L. and *Ormosia dasycarpa* Jacks.) used in the adulteration of "Jequirity".

(1) See also N. 214, *B.* Jan. 1912. (*Ed.*).
(2) See. No. 262, *B.* March 1913. (*Ed.*).

37 – **The Forcing of Spanish Iris.** — *The Gardener's Chronicle*, Vol. LIV, No. 1404, pp. 357-358. London, November 22, 1913. MARKET GARDENING.

Spanish Irises (*Iris Xyphium*) cannot be forced like most bulbs, but can only be induced to flower a few weeks earlier. Boxes 12 to 15 inches square and 3 to 4 inches deep are most suitable for the purpose. No leaf mould or manure is required, but the top layer of a well-manured and limed soil is required and it should be sterilised by steam or chemicals before use. The bulbs are pressed into the soil until they are ½ inch below the edge of the box, and covered to a depth of 3 or 4 inches with ashes. The temperature of the house should be maintained equable at about 45° F.

Experiments with several varieties gave the following results:

Variety	Cold House		Warm House		
	First bloom ready	Remarks	Date of housing	First bloom ready	Remark
Belle Chinoise . . .	June 23	Intense yellow Good growth	Jan. 19	Apr. 20	Fair
Blanche Fleur. . . .	May 29	Good growth	Jan. 19	Apr. 22	Good
Louise	May 27	Good Pale blue	March 20	May 10	Good
Alex. von Humboldt.	—	—	Jan. 19	May 10	Bad
British Queen. . . .	May 24	Good Pure white	March 20	May 10	Good
Count of Nassau . .	May 28	Good. Blue	Feb. 26	May 26	Good

A box of each of the above varieties was kept at a temperature of 60° to 65° F. The buds came up plump and healthy and then withered in spite of ample supplies of water; this suggests that these bulbs have not sufficient latent vitality to develop under hard forcing.

38 – **Forest Protection in Canada.** — Forest Protection for the Dominion. — *Communicated by* T. K. DOHERTY, *Commissioner for the International Institute of Agricutture in Canada.* FORESTRY.

Roughly speaking, Canada has a forest area of 781 000 square miles. But in spite of the fact that the country possesses such great areas of timberland it has been recognised within recent years that the supply was being rapidly depleted. This depletion was due not so much to the legitimate utilization of timber as to the enormous waste caused by forest fires and inefficient lumbering methods. As a result of this, the governments of the several provinces, as well as the Federal government, wisely undertook to put a stop to these losses. At the present time all of the provinces which possess forests have some form of legislation looking to the protection of their timberlands from fire.

In order to show the progress that has been made, as well as what may yet be attempted, the Commission of Conservation has, through its forester, Mr. Clyde Leavitt, just completed a report on forest protection in Canada. The report gives a resumé of what has been accomplished through the operation of the well known order No. 16570 of the Board of Railway Commissioners, respecting the prevention of forest fires along railway lines. It further points out the splendid progress that has been made by British Columbia in holding the number of forest fires in that province to a minimum and explains the working of existing legislation on the prairies in Ontario, Quebec and the Maritime Provinces.

A special feature of the report is the discussion of the brush disposal problem in lumbering operations. In this regard the experience of the United States in preventing fires in national forests, as well as the work that is being done by the Western Forestry and Conservation Association is fully explained. The working of the topping law as applied to the forests in the Adirondacks is also covered fully. The use of oil fuel by railways in regions subject to forest fires is given considerable attention, and the opinions of the officials of railways using oil are quoted copiously. A section of the report is also given over to a discussion of forest planting in Canada.

The report as a whole should prove to be a valuable source of information to those who are interested in conserving Canada's forests.

39 – **The Palmyra and Dum Palms in West Africa.** — De Gironcourt, G. in *Annales de la Science agronomique*, Year 30, No. 4, pp. 408-419. Paris, October 1913.

The wood of the Palmyra palm (*Borassus flabelliformis*) is very valuable for building on account of its large dimensions and rigidity. Its popularity leads to unfortunate results, for its utilization for European buildings takes precedence over the numerous uses of the leaves and fruits, so that there is danger of its extinction in the parts of the Sudan bordering on the Sahelian zone (upper Senegal and Niger).

The natives make use of the pericarp only; the kernels, which constitute one-third of the weight, may be used as a substitute for coroso, and a price of £16 per ton has been offered for them at Hamburg.

Certain precautions must be observed before a marketable production can be obtained. The nuts should be gathered soon after their fall to prevent germination, and the kernels must be thoroughly dried before opening, to prevent mould. At present two concessions have already been sought in West Africa.

The writer also deplores the disappearance of the dum palm (*Hyphæne thebaica* var. *oethiopica*) (1) from the Upper Niger region, owing to its careless exploitation for use with steam engines. An example from south of Timbuctoo shows remarkable results from careful reservation of this tree. The Governor of Togo, Count Zech, has proved without doubt the possibility of checking this careless exploitation by inculcating a better appreciation of this tree amongst the natives, thereby encouraging its planting and promoting the development of the colony.

(1) See No. 2714, *B.* Aug.-Sept.-Oct. 1911. (*Ed.*).

LIVE STOCK AND BREEDING.

40 – **Malignant Oedema in Sheep.** — EHRLICH in *Landwirtschaftliche Wochenschrift für die Provinz Sachsen*, Year 15, No. 47, pp. 387-388. Halle a. S., November 22, 1913. HYGIENE.

The writer gives a short description of Koch's oedema bacillus, the cause of the above disease, which occurs in Germany under the forms of a purulent inflammation of the vagina and uterus, an inflammation due to injuries during shearing, and as an inflammation resulting from dog bites or infection during castration. The following preventive measures and remedies are recommended.

1. Affection of vagina and uterus: segregation of lambing and sick ewes, which should be kept scrupulously clean; the injection of oxydizing disinfectants into the diseased parts.

2. Inflammation of shear-wounds: disinfection of the wounds with benzine and a solution of pyoktaniniodine tincture (to be prescribed by the veterinary) immediately after shearing.

3. Inflammation from other wounds: thorough disinfection of the wounds after castration.

41 – **Studies of the Endogenous Metabolism of the Pig as Modified by Various Factors.** — MC. COLLUM, E. V. and HOAGLAND, D. R. (Laboratory of Agricultural Chemistry, University of Wisconsin) in *The Journal of Biological Chemistry*, Vol. XVI, No. 2, pp. 299-326. Baltimore, November 1913. ANATOMY AND PHYSIOLOGY.

Pigs were fed on a nitrogen-free diet of carbohydrates, salts, and water. The urine was collected daily, and the amount of nitrogen present under the form of creatinine, creatine, ammonia, and urea, as well as the total nitrogen, was estimated.

On a diet of starch and alkaline salts the total nitrogen output attained its minimum value; the creatine content was constant and approximately equal to 18.5 per cent. of the total. When the alkaline salts were replaced by neutral salts the total nitrogen rose immediately owing to an increased output of ammonia, while the urea and creatinine remained approximately constant; the same effect was obtained by feeding hydrochloric acid.

The substitution, wholly or partially, of starch by fat in the diet had no effect on the total nitrogen output, while the total creatine (creatinine + creatine) was in one case increased and in another decreased, possibly owing to the fact that one animal was receiving neutral salts, while the other received basic salts. Finally, the addition of up to 16 gms. daily of benzoic acid to the diet had no permanent effect on the output of total nitrogen, ammonia or creatinine, but the urea was decreased and the writers are of opinion that the nitrogen lost in this form is converted into hippuric acid.

FEEDS AND FEEDING.

42 – **New Method for Calculating the Value of Foods from the Point of View of the Production of Milk.** — HANSSON, N. in *Meddelande No. 85 från Centralanstalten för Försöksväsendet på Jordbruksområdet, Husdjursafdelningen* No. 12.

During the last quarter of last century the method for calculating the nutritive value of the various fodders on the basis of their chemical composition which prevailed in agricultural literature was little followed by Scandinavian breeders. It was too complicated, and moreover experience had shown that the values calculated did not always correspond to their effect; this was especially noticed in comparing coarse fodders (hay and straw) with concentrated foods.

In 1887, in Denmark, feeding experiments were undertaken with the object of determining the proportions in which the various foods could replace each other in a practical feeding ration for cows without affecting their production. In the economic control of dairies carried out by the control associations the relative values thus found and expressed in "food units" were increasingly used, especially for the practical calculation of rations. The number of these associations has increased to such an extent since the beginning of the century, that they at present exert a directing influence on animal husbandry in Sweden as well as in Denmark. On the other hand the experience gained by the work of control has contributed to confirm and in some cases to correct the relative values of all the common foods.

The correctness of the values in food units was later confirmed by Kellner's starch values, which, like the values in forage units, were a measure of the total effect of the fodders. One food unit corresponded on average to 0.605 kg. (1.33 lb.) of starch value, but there were exceptions; thus the starch value of foods rich in carbohydrates, such as coconut and maize cakes, was equal or even superior to that of cakes rich in protein, whilst the value of these latter in food units, based on feeding tests, was decidedly superior.

This difference is further confirmed by numerous feeding experiments which in Sweden have included 32 different foods. (Summarized in *Fühlings Landw. Zeitung*, 1909-1913). With the aid of the results of these tests, the writer has shown the cause of the differences between the two methods of calculating the relative values of foods. By means of the results of tests made with cakes and soya meal, he was already able to show in 1909, that for milk production protein in quantities greater than the necessary minimum had, in comparison with nitrogen-free substances, a value superior to that found by Kellner in his experiments with fattening animals.

This conclusion was confirmed by feeding experiments conducted by the writer from 1910 to 1912 with peas, vetches and beans. He replaced quantities equal in food units, giving 2 kg. (4.4 lbs.) of a mixture of equal parts of earthnut cake, bran and wheat instead of the same quantity of the ground pulse above mentioned, that is to say that 1.12—1.16 kg. (2.46-2.55 lbs.) of starch value in the mixture of cake and bran are replaced by 1.33-1.38 kg. (2.93 to 3.04 lbs.) of starch value in the pulse, and yet in five series of experiments the latter gave an average production of milk and of fat inferior to that yielded by the mixture of cake and bran. Thus the

starch value did not prove an exact measure of the feeds used for the production of milk.

According to the writer, this difference between Kellner's starch values and the Swedish and Danish food-unit values depends upon the fact that Kellner's figures are the result of fattening experiments with steers, whilst the Swedish food-unit values are founded on experiments with milch-cows. In other words the starch values serve to measure the value of the various foods from the phint of view of the formation of fat, while the food units consider them from that of the production of milk. Fats, carbohydrates and crude fibre have the same value in the two cases, but protein is more advantageously used in the production of the milk proteins than in the putting on of fat.

It must be considered that the calorific value of the proteins of the fodder is so well utilized in the formation of similar bodies in the milk, in the foetus and in the digestive liquids, that the effective value of the digestible protein of the fodder in relation to that of the digestible carbohydrates corresponds to the full calorific value of the protein.

The writer's calculations have verified the correctness of this opinion, as when he reckoned the digestible protein of the fodder at 1.43 (corresponding to the total calorific value of the protein) instead of at 0.94 (Kellner's figure), the calculated values corresponded to those which resulted from the feeding experiments. The writer has thus introduced a method for calculating the milk- producing value which only differs from Kellner's method for the calculation of the starch value as regards the figure for the reduction of protein.

The following is an example of such a calculation for earthnut cake, the total relative value of which was 98.

Digestible protein	39.6 × 1.43	= 56.6
Digestible fat	7.2 × 2.41	= 17.4
Nitrogen-free extract 21.2 Digestible cellulose 0.7	21.9 × 1.00	= 21.9
	Total	95.9

$$\frac{95.9 \times 98}{100} = 94.0 \text{ kg. (206.8 lbs.) of milk-producing value.}$$

The effect of 1kg. (2.2 lbs) of digestible carbohydrates is thus the unit of milk-producting value, as it is of starch value.. The difference between these two notions is that the starch value considers protein only according to its effect on fattening, while the milk-producing value expresses the effect of fodder in the case in which all the calorific energy of the proteins is utilized for the production of milk. The two values are very nearly the same for fodders poor in protein, the difference being insignificant for hay, green food and cereals, but more marked for pulse and cakes rich in protein. The principle of recognizing in foods rich in protein a feeding-value higher than their starch value is not opposed to Kellner's opinion on the starch value, as he calculates the money value of the foods on the basis of a fundamental price, not only per kilogram of starch value but also per kg. of protein.

The table given on the neet page gives the necessary figures for calculating

Milk-producing value of foods.

	Content of digestible matter					Value for the production				
							per 100 kg.			
	Protein	Starch	Fat	Nitrogen-free extract	Fibre	Total relative value (Wertigkeit Kellner)	Starch value	Milk-producing value	1 Food unit = kg. of fodder	Ratio of milk-producing unit to food unit = 1 to:
Earthnut cake	39.6	1.4	7.2	21.2	0.7	98	74.9	94.0	0.8	0.75
Sunflower cake	28.7	2.6	10.3	19.0	3.5	95	70.6	83.9	0.9	0.76
Coconut cake	12.5	0.4	7.1	29.9	9.4	100	68.2	74.3	1.0	0.74
Barley	6.5	1.0	1.7	6.7	1.4	99	72.0	75.2	1.0	0.75
Mixture (½ barley, ½ oats)	7.4	1.0	2.7	52.1	1.9	97	67.4	68.2	1.1	0.75
Oats	7.7	1.0	4.0	44.7	2.3	95	59.6	63.2	1.2	0.76
Peas	17.2	3.0	0.9	48.8	2.5	98	68.0	76.2	1.0	0.76
Vetches (seed)	20.0	2.9	1.6	45.8	2.8	96	65.9	75.3	1.0	0.75
Clover hay	5.5	3.0	1.7	26.0	11.3	70	32.0	33.9	2.2	0.75
Mixed hay (clover and grasses)	4.2	1.5	1.1	25.3	12.1	67	29.1	30.5	2.5	0.76
Meadow hay	4.2	1.3	1.0	24.3	15.5	64	29.2	30.5	2.5	0.76
Barley straw	0.7	0.2	0.5	19.0	21.3	45	18.9	19.0	4.0	0.76
Mangolds	0.4	0.6	0.1	7.4	0.7	87	7.5	7.7	10.0	0.77
Swedes	0.5	0.5	0.1	8.1	0.8	87	8.3	8.5	9.0	0.77
Turnips	0.4	0.5	0.1	5.2	0.7	87	5.7	5.9	12.5	0.74
Green food (oats and vetches)	1.4	0.8	0.3	4.9	2.3	80	7.3	7.8	10.0	0.78

the milk-producing values, as well as the values of the foods usually employed in the feeding of live stock. In order to institute a comparison, the writer has also inserted the starch values and the quantities equal to a food unit according to the scale employed in Sweden. The conformity of these units to the new values is shown by the figures of the last columns. As is seen in the last column, one food unit is generally equivalent to about 0.75 of the new values, that is to say that in a mixture of fodders satisfying the protein requirements of cows and calculated according to the above-mentioned method, 1 kg. of barley, 1.1 kg. of the dry matter of roots, or quantities of other foods according to 0.75 kg. of milk-producing value, are to be considered as one food unit. As the digestible carbohydrates which serve as unit of this valuation are used on an average for direct produc-

tion with only 3.6 calories per gramme, one food unit contains about 2.7 calories utilizable for the production of milk. In order to satisfy the requirements as to protein, the food unit must contain 100 gms. of digestible protein in the maintenance ration and 135 gms. in the productive ration.

The writer's method of calculation has removed one difficulty which was much felt in the valuation of the various fodders necessary in the control calculations required at dairies. The values of food units are all based on feeding experiments made with fodders of average quality and are only applicable to such fodders. But in practice it often happens that fodders of superior or inferior quality have to be used. In such cases, there has not been hitherto any method for determining exactly the nutritive value. Roots may be valued on the basis of their content in dry matter, which is almost entirely digestible and of equal nutritive value. It is especially in the case of coarse fodders which have a higher and more varied content of undigestible fibre that a base has been wanting for the valuation of nutritive value.

By means of the new method of calculating the milk-producing value of fodders, this difficulty has been overcome and such a valuation may also be made for fodders of the most varied composition, provided their content of digestible matter is known. By this possibility of determining the nutritive value of fodders on the basis of chemical analysis, the Scandinavian valuation by food units, which was hitherto purely empirical, has received a scientific basis.

3 – **A Study of the Correlation between Racing Performances and Breeding Value in Brood Mares.** — ROBERTSON, J. B. in *The Bloodstock Breeders' Review*, Vol. II, No. 9, pp. 185-197. London, October 1913. BREEDING.

The writer attempts to ascertain whether there exists any association between a mare's racing ability and her power to produce offspring possessing high-class racing qualities. With this object in view he has extracted from the Racing Calendar the performanecs of the dams of the winners of the

	Dams of 189 classic winners 1862-1913	Dams high class performers	Random sample of 1000 brood mares G. S. B. Vol. XXI.
	per cent.	per cent.	per cent.
ROUP I. — Never ran	14.8	21.2	36.5
ROUP II. — Ran, but showed no form .	13.2	13.7	29.5
ROUP III. — Showed moderate form . .	20.6	20.0	14.5
OUP IV. — Fair winners	25.4	26.3	16.6
OUP V. — Good winners	13.8	10.8	2.5
OUP VI. — High-class race mares . . .	12.2	8.0	0.4

Derby, Oaks, St. Leger, and Two Thousand and One Thousand Guineas during the last 30 years and classified them. The result of these investigations is given in the first column of the accompanying table. In the second column are given the dams of racehorses which were not three-year-old classic winners, but yet were high-class performers. In the third column are included 1000 mares of the General Stud Book (G. S. B.) taken at random. Thus the performance of the dams of winners and high-class performers can be compared with the average performance of brood mares of the G. S. B.

It will be seen from the above table that over 12 mares in every hundred which have bred classic winners, were either classic winners themselves or very high-class race mares, whereas in the General Stud Book there are only 4 mares in every hundred which could be so described. Considering the first two groups of the table it will be seen that 66 per cent. of the mares in the General Stud Book either never ran or showed no form, as against 28 per cent. of the dams of classic winners. In fact whichever group be examined the result points to the conclusion that the chance of breeding a clasic winner is very much greater from those mares which have racing performances to their credit than from the others.

44 – **Colour Inheritance in Swine.** — Smith, W. W. in *American Breeders Magazine* Vol. IV, No. 2, pp. 113-123, Washington, D. C., 1913.

As a result of 12 matings between pigs of the white Yorkshire breed and of the black Berkshire or Poland China breeds, 115 individuals were obtained, all white. Crossbred Yorkshire × Berkshire of the F_1 generation were mated together and produced 26 pigs of which 20 were white and 6 black splashed with white, while crossbreds mated with Berkhire gave 65 pigs of which 32 were white and 33 black with some white. All the recessive blacks of the F_2 generation carried more white than the original black parent.

The offspring of a white $^3/_4$ Poland China sow by a Poland China sire, consisting of 21 individuals, could be divided into four classes, *viz*:

11 black with a little white;
2 white » » black;
1 half white and half black;
2 all white.

These results show the complete dominance of white over black in the generation and a general tendency for the original parent colour to be expressed separately in the F_2 generation in the proportion of 3 dominants to 1 recessive. But the fact that in nearly all cases the recessive black of the F_2 generation carried more white than the original black parent suggests that each colour may be made up of a number of germinal factors rather than of a single factor.

45 – **Stock-Breeding in Tripolitania. The Export of Stock and of the Products of the Stock-Breeding Industry.** — *Ministero delle Colonie, Bollettino di Informazioni*, Year I, No. 4, pp. 163-206. Rome, October 1913.

Stock Production and Export. — The annual production of cattle in Tripolitania amounts to 50 000 head. The animals are exported to Malta and Sicily. In 1907 and 1910, Italy imported Tripolitan cattle to the value of £968 and £57 140 respectively.

These animals are small, powerful, strongly built, and average 660 lbs. in weight; before the war they fetched about £6 per head. The Orfella and Gebel breeds are considered the best; the former are good milkers, and the latter excellent draught animals. The milk yield of an Orfella cow during a six months' lactation period is reckoned at 220 to 260 gallons. The cattle would be more profitable, if provision were made for water and fodder during the dry season, and due attention paid to the castration of unsatisfactory bulls, selection, the increase of the herds, and the control of cattle diseases. In order to increase milk production, the cows should be rigorously selected, and they should be supplied with green forage during a longer period of the year. Cattle are sold for ready money at the market, and either at a valuation, or according to their live weight.

The number af horses bred annually amounts to 10 000 and the value of those exported every year is estimated at about £4000. Of these exported animals, one-third go to Malta and two-thirds to Sicily. The Turkish Government used to encourage horse breeding by prohibiting the export of brood mares and, at times, that of stallions also. The best horses are produced in the districts of Tarhuma and Orfella; only stallions come into the market. To promote and improve horse breeding, suitable measures should be adopted, such as better keeping, careful selection, and perhaps the establishment of stud-stations and other similar reforms.

Asses are much bred in the interior, about 50 000 being produced annually. The Tripolitan ass is usually black and stands 10 hands high on an average. It is an excellent worker, and its average price is £1 12 *s.*

The annual production of sheep is estimated at 100 000. Of the exported sheep 10 per cent. go to Malta, the rest almost exclusively to Egypt. Three breeds are distinguished: the Orfella sheep, the fat-tailed Gebel sheep, and the large woolless Sudan sheep. The Tripolitan sheep is exported as a rule for its mutton, but is also exported frequently to Malta and Sicily for breeding purposes. In Tripoli, where fat is employed for seasoning, the fat-tailed breed is predominant. The average weight of these animals is 77 lbs.; the rams weigh 88 lbs., and lambs at 4 to 6 months 40 lbs. The milk yield during the lactation period, which lasts 3 or 4 months, amounts to 4 ½ gallons. The sheep are very heat-resistant and fairly prolific; on account of the numerous diseases which prevail, they have rather poor fleeces. In order to improve them, it would be necessary to induce the natives (to whom all the flocks belong) to pay more attention to the management of the animals, and to castrate and fatten all unsatisfactory rams. Crossing with European breeds would, at present, be useless. The average price in Tripoli per head is £1, for rams £1 4*s* and 16*s* to £1 for lambs.

Goat keeping is very general in Tripolitania ; the breed is of average size, and the animals are black. Their live weight amounts to 66 to 88 lbs. A kid at 2 to 3 weeks old weighs 11 to 15 lbs. Cloth is made from the shorter finer hair, and ropes from the longer. Under favourable conditions, a goat gives 1 $^3/_4$ pints of milk daily; the milk yield of the whole lactation period amounts to 13 to 33 gallons. The natives prefer to mix the goats' milk with ewes' and cows' milk when making butter and cheese. The breed could be improved by better feeding, systematic organisation of the the sale, and rigorous selection of the animals.

Tripolitania possesses two important breeds of fowls: the Arab and the Turkish. The first are good layers ; they are chiefly kept in the interior of the country and fowls are often sent to Malta and fetch 4*d* per lb. The Turkish fowl is somewhat larger and fattens better, but is not such a good layer as the Arab. The hens weigh 4 ½ lbs. and the cocks 5 ½ lbs. Other breeds of poultry are little kept in Tripolitania.

The Production and Export of Animal Products. — The annual native production of hides is valued at £26 000 ; one quarter is used in the country, and the remainder is exported. France and America are the best customers, after which come Greece, Turkey and Asia Minor. The skins are dried in the shade, and then treated with a 4 per cent. solution of potassium arsenate. Goat skins are worth, on an average, 1*s* 7*d* each, cow and ox hides £2 16*s* 5*d* to £3 12*s* 7*d* per cwt. and camel skins from £1 8*s* 3*d* to £1 16*s* 3*d* per cwt. Many hides and skins fetch lower prices, because they are dirty, contain holes, or are attacked by diseases (especially warbles). Prices are highest in summer and autumn, as a rule, and lowest in spring and winter. The skins from the Sudan are exclusively those of goats, and are brought by caravans to Tripoli. This trade was at one time of much importance, but is now insignificant, owing to establishment of water and railroad communication. From 1887 to 1896 the average annual value of the skins exported from the Sudan was £32 000 ; to day it is still £12 000. The goat skins are tanned in the Sudan, and usually dyed red or yellow for the market. The natives use for tanning vegetable substances such as " gedari ", " afs-el-battum ", " adze ", " burbu " and pomegranate bark. The natives select in Tripoli those skins which are destined for export to America. They take the average weight of 12 skins as a criterion ; this should be between 11 and 13 lbs. Delivered on board ship at Tripoli such skins fetch from 1*s* 5*d* to 1*s* 7*d* per lb. The goat skins are chiefly exported to Boston, for which port they are made up into bales, each containing 25 doz. In Boston, the skins are thoroughly tanned, and then sold to be made into boots, etc. So far, the attempt to introduce Sudanese skins into the European markets has met with no success.

Before the war, the annual wool production of Tripolitania amounted to 3 300 000 lbs., while 1 760 000 lbs. were exported, 1 320 000 lbs. being sent to France and 440 000 to Italy. The production depends upon the supply of forage, and in years of drought is scarcely sufficient to meet home requirements. The wool is coarse ; it is unequal, except in the best flocks, and is usually grey or black, and often speckted with white, but rarely pure

white, and its quality is inferior. During the sale season, *i. e.* from April till July, unwashed wool fetches 3 ½ *d* per lb., and washed wool 7 ¼ *d* to 8 ¼ *d*. The principal markets are Marseilles and Genoa ; after these come Triest and Malta. Marseilles offers the advantage of a more ready sale, Genoa that of greater net profit. Bengasi wool is better, and consequently somewhat dearer than the Tripoli product.

Formerly, Tripoli exported annually about 250 tons of bones, valued at £720 ; this export does not now exceed 120 tons, estimated at £600. Of these bones 90 per cent. are cow and sheep bones, while 10 per cent. are those of horses and asses. Most of the bones exported go to France and Italy.

Before the war, the egg export trade was of considerable importance. From 9 to 10 million eggs were exported annually, of which about half went to Italy. Italy was a customer in the spring and winter, France in January and February, while eggs were exported to Tunis in the summer, and to Malta throughout the year. The price varied in winter (including the cost of packing) from 9*s* 6*d* to 11*s* 10*d*, and in summer between 7*s* 11*d* and 8*s* 8*d* per 1000, at the harbour of Tripoli.

46 – **Studies in Milk Records.** — (1) GAVIN, W. The Interpretation of Milk Records. — *Journal of the Royal Agricultural Society of England*, Vol. 73 (1912), pp. 153-174. London, 1912. — (2) ID. The Influence of Fœtal Growth on Yield. — *Journal of Agricultural Science*, Vol. V, Part 3, pp. 309-319. Cambridge, 1913. — (3) ID. On the Accuracy of Estimating a Cow's Milking Capability by her First Lactation Yield. — *Ibid.*, Vol. V, Part 4, pp. 377-390. Cambridge, 1913. CATTLE,

1. The writer, who holds the position of Scientific Expert to Lord Rayleigh's Dairy Farms, has made a statistical study of the milk records of 2665 cows accumulated in the course of 24 years. He points out that in studies of the inheritance of milk yield in cows, it is difficult to assign a definite numerical value to the inherent milking capacity of each individual, as such figures as total yield per calf or per calendar year, average per week, etc., are subject to wide fluctuations from external causes ; to make them of value, it is necessary to enumerate in every instance the particular circumstances in which the cow in question has been placed during the given period. In a statistical study this is naturally impossible, hence the necessity of defining a cow's milking capability by one single unqualified figure.

He classifies the external circumstances affecting yield under the following headings:

1) Age of cow.
2) Number of weeks in milk.
3) Number of weeks rest before calving (*i. e.* since the end of the previous lactation period).
4) Interval between calving and subsequent service.
5) Time of year of calving.
6) Food, weather and general treatment.

He then proceeded to select a figure which should be affected by the minimum number of factors and to estimate as accurately as possible the

effect of those influences under which it does fall. After a preliminary examination of the data, three figures were selected for comparison :

I. Average yield per day from the 5th to the 12th week after calving, or A.

II. Maximum yield on any one day, or M.

III. Revised Maximum, being the maximum day-yield reached or exceeded three times in any given lactation (*i. e.* the highest figure common to three entries in the record book), or R. M.

These figures should be outside the influence of the external factor, 2), and little effected by 4). The writer proceeded to compare their variability, and also their correlation with lactation totals, or L. T. (total yield per calf) both in normal and abnormal lactations. (Table I).

TABLE I.

	Abnormal (short)	Normal Lactations			Abnormal (long)	All Lactations
Weeks in milk	30–34	35–45	40–45	41–45	55–60	
No. of cows	167	1 233	696	590	172	2 665
Variation coefficients:						
L. T.	26.45	25.72	25.28	25.46	26.76	31.69
A.	25.98	25.78	26.77	27.13	28.54	27.56
R. M.	26.08	24.77	—	26.11	—	26.44
M.	25.83	24.68	25.55	25.05	28.32	26.08
Correlation with L. T.:						
A.	+ 0.885	+ 0.858	+ 0.879	+ 0.878	+ 0.873	
R. M.	+ 0.831	+ 0.844	—	+ 0.876	—	
M.	+ 0.823	+ 0.839	+ 0.869	+ 0.876	+ 0.832	

From this table it would appear that M is the least variable function of a cow's milk-production and that all the correlation coefficients seem high enough to justify the use of any of the three above figures as determinants of a normal cow's yield. The mean A, R. M., and M. were all calculated for the different lactation periods given above and showed very little variation. There was if anything a slight tendency to rise with the length of the lactation, but the point requires more investigation.

Now of the three figures A would be exposed to greatest error from those influences which are general in character and tend to act in the same direction for considerable periods, such as temperature, time of year, food, method of feeding, rainfall, housing, etc.. ; for during an unfavourable period which would depress A, it might well occur that on one day favourable circumstances combined to allow the cow to show what her real capability was, while in a lactation period where the conditions were favourable A would be increased while M. would remain the same. On the other hand records based on a single entry are liable to serious errors such as late milking, extra food, clerical mistakes, etc... To avoid both extremes the writer finally selected the R. M. as the most suitable unit ; it possesses the further practical advantage over A of requiring no calculation. He then estimated to what extent the R. M. was influenced by certain disturbing factors :

Influence of Age. — The mean R. M. for 110 cows was as follows :

Mean R. M. with	1st	calf or mean	R. M_1. =	9.8 quarts
»	2nd	»	R. M_2. =	12.8 »
»	3nd	»	R. M_3. =	14.4 »
»	4th	»	R. M_4. =	15.3 »
»	5th	»	R. M_5. =	15.8 »
»	6th	»	R. M_6. =	16.0 »

When these values were plotted, the curve was smoother than that obtained from the L. T. of the same 110 cows or than that of calendar year totals of 125 other cows. The maximum is not reached till the 6th calf, but there is little increase after the 4th calf. The writer suggests a rough correction for estimating the mature capability of a cow from R. M_1 R M_2, R. M_3, but the subject is discussed in detail in a subsequent paper.

Influence of season of calving. — The mean R. M. for cows calving in each month of the year was calculated on a total of 1418 cows and is given in the following table (II).

The highest means of R. M. occur with cows calving in April and May, and the lowest in August calving cows, corresponding to the supply of natural succulent food. Mean monthly L. T. of 731 of the cows with normal lactations showed very similar variations, but maximums occurred with cows calving in November and December, and then gradually decreased till August. The writer tried various corrections to reduce the error due to season of calving and finally suggests the following, which proved the most suitable as a provisional measure.

For cows calving	April and May . . .	Deduct	5	per cent.	from	R. M.
»	July . . .	Add	5	»	to	»
»	August. .	»	10	»	»	»

Influence of period of rest. — 347 cows were divided into four groups according to the number of weeks rest they had before calving, and the mean R. M. for each group was estimated. The figures were practically identical, so no correction need be made on the R. M. on this account.

TABLE II.

Month of calving	No. of Records	Mean R. M.	Deviation of monthly mean from mean for year
		quarts	
January	136	14.3	+ 2.1 per cent
February	175	14.6	+ 4.2 »
March	104	14.7	+ 5.0 »
April	73	15.5	+ 10.7 »
May	87	15.3	+ 9.3 »
June	139	13.2	— 5.7 »
July	153	12.7	— 9.3 »
August	112	11.5	— 17.9 »
September	67	14.8	+ 5.7 »
October	125	14.4	— 2.9 »
November	104	13 8	— 1.4 »
December	143	13.8	— 1.4 »
		Mean 14.01	

2. — In this paper are given the results of an investigation into the influence of the time of service on R. M. 1419 records were first examined to determine the time after calving at which the maximum yield first occurs. The records were divided into five groups according to whether the cows calved in (I) April to November inclusive, (II) December, (III) January, (IV) February, (V) March, and tabulated according to the time which had elapsed between the time of calving and the date of maximum day yield (Table III).

It will be seen that 84 per cent. of the total number of cows reached their maximum day yield by the 8th week after calving, 92 per cent. by the 12th week and 97 per cent. by the 16th week. Three-quarters of the 8 per cent. that had not reached their maximum by the 12th week were January and February calvers, leaving only 2 per cent. for cows calving during the remainder of the year. Taking the Jan. and Feb. calvers by themselves, only 72 per cent. of the former gave a maximum before the 12th week, but 97 per cent. had given it by the 20th week. February calving cows alone shew corresponding figures of 74 per cent. for the 12th week, and 100 per cent. for the 20th. When these figures are plotted in curves superimposed on one another according to

TABLE III.

Percentage of cows reaching maximum day-yield during:

Date of calving	Weeks after calving							No. of records.
	1st to 4th	5th to 8th	9th to 12th	13th to 16th	17th to 20th	21st to 24th	25th to 28th	
April to November .	67.5	29	2	0.5	0.5	—	0.5	862
December	55	27	10	0.5	3.5	4	—	141
January	40.5	28	3.5	12.5	12.5	3	—	136
February	41.5	15	17.5	24.5	1.5	—	—	176
March	23	31.5	38.5	7	—	—	—	104
All months	57	27	8	5	2	1	—	1419

TABLE IV.

Average daily yields.

Weeks after calving	No. of weeks after calving when served					
	5th to 8th	9th to 12th	13th to 16th	17th to 20th	25th to 28th	37th to 40th
3rd and 4th . . .	100	100	100	100	100	100
(Average daily yield in quarts) . . .	(14.8)	(14.1)	(13.7)	(14.0)	(13.3)	(13.2)
5th—8th	97*	99	99	98	98	97
9th—12th	88	90*	86	90	89	88
13th—16th . . .	81	82	77*	82	77	79
17th—20th . . .	73	73	69	73*	71	71
21st—24th . . .	63	66	63	66	67	64
25th—28th . . .	*52*	59	58	61	63*	60
29th—32nd . . .	*40*	*50*	*51*	55	59	56
33rd—36th . . .	*23*	*34*	*40*	*47*	56	51
37th—40th . . .	—	—	—	—	48	47*
41st—44th . . .	—	—	—	—	*35*	45

* Period of service.
Time after which the foetal growth appears to influence the yields is entered in italics.

their calendar dates, it becomes evident that the delayed maxima are in every case reached about the same season of the year, namely April and May, when the cows respond to the extra stimulus of abundant and succulent green food.

247 records of cows calving in May and June were then examined to determine the influence of the time of service. The cows were divided up into six groups according to the length of time elapsed between calving and time of service, and their average daily yield was estimated for 44 weeks : (see Table IV, on previous page).

It would seem that in no case has foetal growth reduced the yield (as compared with that shewn for the same period by groups where service has not occurred) sooner than 12 to 16 weeks after service. In the case of groups I, II, and V, it appears to have had no influence for 16 to 20 weeks. Since, then, 12 weeks at the very least (and probably 16 to 20 weeks) must elapse between service and any fall in yield due to foetal development, and since 97 per cent. of the cows were found to have reached their maximum day-yield within 16 weeks of calving and 99 per cent. in 20 weeks, the chances of the Revised Maximum being affected by time of service are seen to be very slight.

The table also shows that the milk yield diminishes generally in the absence of gestation and that the decrease due to this cause may be distinguished from that caused by foetal growth. The writer also points out that the rate of fall in both cases is very similar.

3. — This investigation was based on the records of 336 cows which had 5 or more calves. Lactations were measured as R. M. in quarts throughout. The mean R. M. and variation coefficients with the different calves were as follows :

		Variation coefficient
Mean R. $M._1$	9.3 quarts	21.2
» R. $M._2$	12.8 »	16.6
» R. $M._3$	14.2 »	17.8
» R. $M._4$	14.9 »	16.6
» R. $M._5$	15.4 »	17.8

The coefficient of variation is 21.2 with the first calf, after which it falls to the neighbourhood of 17. Determinations made from a smaller number of cows revealed a tendency to rise again after the 5th calf. The increased variability of the 1st lactation yield seems more likely to be due to the greatly varying condition in which heifers are brought into the milking shed than to have any physiological basis. Differences in feeding and general treatment, and most of all in age, must influence very greatly the first lactation yield, and this influence must tend to decrease as the milking career advances. In considering the correlation between the first and subsequent lactation yields, it becomes necessary to decide on a figure to represent a cow's mature capability. For reasons analogous to those for which R. M. was selected as the figure to represent a lactation yield, the *maximum* R. M. was taken to represent a cow's mature capability, and the following correlation coefficients were obtained :

R. $M._1$	with	Max	R. M.	.394
R. $M._2$	»	»	»	.452
R. $M._3$	»	»	»	.506
R. $M._4$	»	»	»	.605
R. $M._5$	»	»	»	.762
Average of R. $M._1$ + R. $M._2$	»	»	»	.526
R. $M._1$		with	R. M_2	.437
R. $M._2$		»	R. $M._3$	.388
R. $M._3$		»	R. $M._4$	.576
R. $M._4$		»	R. $M._5$	.527

The correlation between R.M_1 and Max. R.M. is low, but can be substantially increased by taking the average of R.M_1 + R.M_2, and the fact that the relationship between all successive lactations is somewhat distant makes the correlation between R. M_1 and Max. R. M. more important than the value of .394 alone would indicate.

With regard to the estimation of mature from first-calf yield, a simple factor will not suffice, since cows starting badly tend to increase to a greater proportion of their first-calf yield than those which begin with a higher figure. Recourse must therefore be had to regression coefficients, which are given in the following table, together with the probable error of the estimate (Table V).

TABLE V.

Lactation	Regression Coefficient	Probable error of estimate
1st	.57 ± 0.050	1.77 quarts
2rd	.58 ± 0.046	1.66 »
3rd	.60 ± 0.037	1.73 »
4th	.73 ± 0.035	1.58 »
5th	.82 ± 0.026	1.28 »
Average 1st + 2nd	.79 ± 0.053	1.58 »

An example is given of the use of these coefficients, showing that if a cow gives R. M_1 = 7.3 quarts, which differs from the mean by−.2, then her Max. R. M. will be = mean Max. R. M. — (2 × .57)

= 17.14 — 1.14

= 16 quarts.

Further the chances are *even* that this estimate is correct within the limits of 1.8 quart. The inaccurracy is likely to be greater than this, since regression of R. M_1 has not yet been shewn to be linear.

Table VI is given for estimating the Max. R. M. from R. M_1, and from the average of R. M_1. and R. M_2..

TABLE VI.

R. $M._1$	Calculated Max. R. M.	Limits of probable error	Lactation total corresponding to Max. R. M.
qts.	qts.	$\pm$ 1.7 qt.	gallons.
5	14.6		685
6	15.1		709
7	15.7		733
8	16.3		757
9	16.8		781
10	17.4		804
11	18.0		827
12	18.5		851
13	19.1		874
14	19.7		898
15	20.3		921
16	20.8		944
Average R. $M._1$ + R. $M._2$		$\pm$ 1.6 qt.	
7	13.7		651
8	14.5		684
9	15.3		717
10	16.1		750
11	16.9		783
12	17.7		816
13	18.5		849
14	19.3		882
15	20.1		915
16	20.9		948

315 cows were also divided into three classes according to whether their R. M_1 was under 10 quarts, 10 to 12 quarts, or over 12 quarts, and their mean R. M. was calculated for subsequent lactations. (Table VII).

TABLE VII.

Class	No. of cows	Mean					Average of all lactations	
		R. M_1	R. M_2	R. M_3	R. M_4	R. M_5	R. M.	Corresponding lactation total
		qts.	qts.	qts.	qts.	qts.	qts.	gallons
C. 5–9 quarts .	153	8.1	11.3	13.7	14.4	15.4	12.6	604
B. 10–11 » .	112	10.4	13.3	14.7	15.3	15.9	13.9	658
A. 12–17 » .	50	13.0	14.9	16.1	16.4	16.9	15.5	724

Assuming milk to be worth 8*d* a gallon, an average cow of class A would give a return of £20 more than an average cow of class C. In practice it appears that cows of class C should be discarded after their first calf unless any extenuating circumstances are present, in which case a more reliable judgment can be formed of the cow's subsequent value by the mean R. M_1 + R. M_2. Cows of Class B will probably pay to keep, but will probably not turn out high yielders, while Class C will tend on the whole to maintain a good proportion, though not all, of their original start.

In conclusion, the writer points out with regard to the practical application of his results, that the definition of a cow's mature capability by means of her Max. R. M. implies many years' delay and reduces the available number of records by excluding all cows which did not reach maturity. Therefore it is advisable that a uniform system should be formed to deal with immature cows by calculating the Max. R. M. from the data available in each case. It is possible that calculation will give in many cases a less accurate result than a prognostication by a practical breeder, but in such work it seems essential that personal bias should be excluded.

47 – **Comparative Investigations into the Performance of the Breeds of Cattle kept in the Province of Saxony, Prussia.** — ERBINGHAUS, H. in *Deutsche Landwirtschaftliche Tierzucht*, Year 17, No. 40, pp. 473-476; No. 41, pp. 490-493. Hanover, October 3 and 10, 1913.

The writer avails himself of the results of five Milk Control Associations in the province of Saxony (Naumburg a. S., Mansfelder Gebirgskreis, Droyssig, Kayna and Witzenburg) in order to compare the cattle of the higher lands with those of the lowlands. The records of the five associations for 672 Simmental cows and 956 Lowland cows show the following results:

In the the Simmentals, the live-weight is 132 lbs. greater than in the Lowlands and the increase in weight 20 lbs. greater. With almost the same consumption of starch-values and the same number of milking days the Black-spotted cattle yield 504 lbs. more milk than the Simmentals, but as their milk contains 0.6 per cent. less fat they fall short of the Simmental in the production of butter-fat by 23 lbs.

The records of the Naumburg a. S. Association (all large farms) are as follows :

Breed	No. of cows	Live-weight	Milk yield	Fat content of milk
		lbs.	lbs.	per cent.
Simmental	44	1 316	5 722	4.17
Red-spotted Lowland.	117	1 247	6 653	3.17
Black-spotted Lowland.	245	1 214	6 844	3.34

The increase in live-weight was greatest relatively in the Red-spotted ; actually this and the Simmental were equal, and 40 lbs. more than the Black-spotted. The Simmental is again first for butter yield, exceeding the Red-spotted and Black-spotted by 27 lbs. and 10 lbs. respectively. There are, however, no marked differences in general performance between the three breeds.

The cows under the control of the Mansfelder Gebirgskreis Association (large and medium farms) were 247 Simmentals, 450 Black-spotted Lowlands and 91 Harz. The result is that for the same ages and number of milking days the Black-spotteds yielded the greatest quantity of milk, both absolutely and relatively, but were run very close by the Simmentals. The Harz cattle yielded 739 lbs. of milk less than the Simmentals. The fat content (3.62 per cent.) and the quantity of fat (397 lbs.) were highest in the Simmentals, while Black-spotted Lowland and Harz cows showed nearly the same quantity of fat (214.5 and 209 lbs.). As regards the consumption of starch values the Black-spotted come first with 3963 lbs.; they are followed by the Simmentals with 3898 lbs., and the Harz with 3656 lbs. Simmentals and Black-spotted Lowlands are relatively and absolutely nearly alike, while the Harz cattle are somewhat inferior, notwithstanding the fact that relatively they exceed the Black-spotted animals in the yield of fat. Great differences, however, do not exist among these breeds.

A comparison of the performances of Simmental crosses (by Lowlands, local breeds, etc.) with pure Simmentals, from the data of three Associations, shows that the crosses give a greater increase of weight but a lower production of milk and fat.

Collecting the results of the investigations, it may be said that under the same economic conditions Simmental cattle possess the following advantages and disadvantages in comparison with the other breeds.

1. — The live-weight and increase of live-weight at the same age are greater than in the other breeds.

2. — The yearly yield of milk is lower than in the Black and Red-spotted Lowland cattle, but higher than in the Harz and cross-bred animals.

3. — The fat content and the quantity of fat produced are greater than in the other breeds.

4. — The consumption of fodder expressed in Kellner's starch-values is essentially the same as in the other breeds, the relative milk yield is lower, but the butter-fat yield and increase of live-weight are greater than in the other breeds.

48 – **The Freiburg Pied Mountain Cattle and their Employment for Crossing with the German Black-spotted Lowlands.** — MÜLLER, P. in *Jahrbuch für wissenschaftliche und praktische Tierzucht einschliesslich der Züchtungsbiologie*, Year 8, pp. 1-87. Hanover, 1913.

In his very comprehensive article, the writer gives a detailed account of the descent and history, as well as of the areas of distribution and breeding, of the Pied Mountain cattle native in the Freiburg Alps (Switzerland). The original home of this breed was in the north, whence it was presumably brought to Switzerland by the Celts many years before the Christian era. It is identical in origin with the Black-spotted Lowland breed, but received blood of other stocks (red Germanic cattle) at a very early period. Its colour alone distinguishes it from the Simmental, to which it is in no wise inferior as regards performance.

The number of Pied Mountain cattle in Switzerland was reckoned in 1911 at 38 196, of which 18 732 were in the Canton of Freiburg, and 6 000 in that of Berne (chiefly on the Jura). The Association of Swiss Pied Cattle Breeders ("Verband schweizerischer Schwarzfleckviehzüchter") in 1911 included 29 breeding societies (28 in the Canton of Freiburg and 1 in Neuenburg) with 45 bulls and 2574 cows.

The Pied Mountain cattle are exported to nearly all European countries, although only in small numbers, owing to their black colouring. Bulls for breeding purposes, when from six to nine months old, fetch £ 20 to £ 32 in the market in Bulle, while yearlings and two-year-olds make £ 32 to £ 100. The latest aims of the breeder are to obtain more even herds and animals with black heads and a white star (the Dutch markings) instead of with white heads. Of the total number of prize bulls in 1911 about 40 per cent. possessed the required black head. The writer gives the Floquet, Marquis-Max and Kapitän lines as those which produce the best bulls.

The milk yield is from 5500 to 13000 lbs.; the average weight of an adult cow from a good herd is 1430 to 1540 lbs., while that of a bull at three to five years may be as much as 2400 lbs. They kill at 58 to 65 per cent.

In the nineties of last century a considerable number of Pied Mountain cattle were brought into Germany, especially for the improvement of

the Black-spotted Lowlands. The first crosses usually proved very satisfactory, but further crossing tended to improve the fattening properties at the expense of the milk yield ; this led to the Freiburg bulls being no longer employed. Further, attempts to breed Pied Freiburgs pure in Germany found little encouragement from the authorities. At the present day, Freiburg blood is still to be found in isolated Lowland herds in Thuringia, in Posen (sugar-beet farms) and in Kulmerland, West Prussia. The writer does not recommend this breed for crossing with the Black-spotted Lowland cattle, though he considers it adapted for special fattening purposes.

49 – **An American View on the Beef Cattle Situation. Present Status of the Industry.** — *Communicated to the International Institute of Agriculture by* W. J. KENNEDY, *Director of Agricultural Extension, Iowa State College.*

The solution of the beef cattle situation is one of the most important problems before our American people. This is something which concerns every man, woman and child in the United States. For the first time in the history of modern civilization our people are facing what appears to be a near beef famine. It has been gradually approaching us ever since 1907. The rapid increase in our population, thus a much heavier demand for beef, has caused high prices for all kinds of meat ; thus many farmers have sold their breeding herds as well as the normal increase. The result has been a marked increase in demand and a very noticeable falling of in supply.

The World's cattle supply. — A shortage at home would not be so serious a matter from the consumers' standpoint, if there were an abundant supply in other countries. For some time the writer has been gathering data concerning the world's supply of cattle. It has been necessary to include all classes of cattle, because few countries outside of our own are able to furnish separate figures for beef and dairy cattle. Fairly reliable figures have been obtained concerning the increases or decreases in the number of both cattle and people in practically all of the leading meat producing and consuming countries of the world since 1900. These figures show conclusively that in all of the countries, except Australia and France, the increase in cattle production has not kept pace with the increase in the number of people. A careful study of the same will clearly reveal the fact that there is a world-wide shortage of cattle and that the most alarming condition of affairs prevails in the United States.

The average increase in population is 19.9 per cent. and of cattle about 2.18 per cent.

Free meats from foreign countries. — A great deal has been said concerning the effect of putting meat on the free list. Some people have claimed that it would insure an abundance of good beef for the American people at moderate prices. Others have maintained that the putting of meat on the free list would drive the American farmer and ranchman out of the cattle raising business, on account of the low prices for meat and consequently of cattle on foot, which were sure to follow such legislation. A careful study of the world's cattle supply would indicate that both factions are almost sure to be disappointed. That there is a world-wide shortage of beef

Country	Population. Increase since 1900	Cattle	
		Increase since 1900	Decrease since 1900
France	2 %	2 %	—
Germany	16 %	4 %	—
United Kingdom	10 %	4 %	—
Austria-Hungary	10 %	2 %	—
European Russia	14 %	—	12 %
Canada	35 %	20 %	—
Brazil	20 %	—	20 %
Argentina	40 %	—	6 %
Australia	18 %	40 %	—
New Zealand	30 %	16 %	—
United States	24 %	—	30 %

cannot be denied. This being true the placing of meats on the free list is not likely to reduce appreciably the prices of beef to the consumer or the prevailing prices for beef cattle. It is a well established fact that Europe is meat hungry and must look to Argentina and Australia for its supplies, and must thus bid against the United States or any other contender in the world's market. Even the most optimistic believers in free meat figure that at the very outside not more than 4000 head of cattle per week, or 2 000 000 lbs. of beef, can be expected. This amount would barely furnish enough beef for our annual increase in population. The very lowest estimates on our annual beef consumption place the amount at 56 lbs. per person, or for the whole population 14 400 000 lbs. per day ; thus our people would eat the entire amount of articipated yearly importation of beef, some 100 000 000 lbs. in about seven days. This is a case where the law of supply and demand will be the controlling factor in the establishing of prices.

Conditions in the United States. — The beef cattle industry of the United States is in a most precarious condition. Between January 1907 and January 1913, the number of beef cattle in the United States decreased by 15 970 000 head, or about 32 per cent. During the same time our population increased about 10 000 000 people. Conditions are going to be worse in the next two or three years. A few weeks' study of any of the stockyards' markets will convince the most optimistic person that there are altogether too many cows, heifers and calves being rushed to market for the future good of the cattle business. It is a most pitiful sight, in the face of the present marked

shortage of cattle, to look over the daily receipts of our southern and western markets and find from 15 to 40 per cent. of the animals offered to be good young she stuff, just the kind that are needed for breeding purposes on the farms. This condition of affairs, if continued, can mean but one thing, namely fewer and fewer cattle in the years to come.

The Farmers' Duty. — It has been said that it is the farmers' duty to feed our people. This must necessarily include meat supplies, one of the most important of which is beef. If he is to fulfil his duty, he must get busy and raise more cattle. The present indications are that the future prices of beef cattle will be high enough to make the business a profitable occupation. Beef production must also be regarded as a factor in the conservation of the fertility of our soil. Soil conservationists claim that every time a bushel of corn is sold off the farm about 16 cents worth of fertility is removed. If corn be fed through beef cattle, but 5 cents worth of fertility is removed. About the same ratio prevails for the other grain and forage crops of the farm. These are factors worthy of careful consideration. There is no more important problem before our American people than the maintaining and building up of the fertility of our soil. Considering the labor involved, no line of farming is better adapted to soil-building than beef production.

Factors necessary to insure successful production of beef in the Corn Belt of America. — 1. — We must put more of our land under blue grass pasture. Many Iowa farmers are getting from $10 to $15 per acre from the blue grass pastures through the utilization of the same for beef production and cattle feeding purposes. This is an excellent way to help solve the labor problem on the farm, as beef cattle require but very little labor during the grazing season.

2.— The farmers of Iowa annually leave from five to seven million acres of corn stalks in the fields, thus very largely wasted. This is a wasteful method of farming, something unknown in the more densely populated countries where land is on a par with or higher in value than our own. A large amount of this waste could be, and will be, eliminated through the use of the silo, and then we shall be able to winter economically more beef cows and young stock on our farms.

3. — There should be some alfalfa grown on every Iowa farm. This is the heaviest yielding, most drought resisting, most palatable and most nutritious crop that can be grown on our farms. No other crop is so valuable in the growing and finishing of baby beef.

4. — The wise farmer will retain his heifer calves and cows for breeding purposes. Future prices for beef cattle should be as high as or higher than those of the present time ; thus it is a short-sighted policy which leads a man to dispose of his breeding stock. This is a time when men should increase, not reduce their breeding herds.

5. — A man to be successful in any line of work must stay by the job. The fellow who is always changing never makes much progress. This is especially true of the beef business. No man can anticipate the high mar-

kets or the low ones, but the man who is always in the business is sure to reap profits when the other fellow is short, that is when the demand is greater than the supply.

50 – **On the Relation between the Fat Content and Natatory Powers of Fish.** — POLIMANTI, Osw. in *Biochemische Zeitschrift*, Vol. 56, Part 5-6, pp. 439-445. Berlin November 5, 1913. FISH

The writer tried to ascertain by means of chemical analysis whether a difference exists in the water and fat content of marine fish of the nekton and benthos which whould account (independently of the swim-bladder) for the different swimming capacity of these two groups. It is shown by the data given in the tables, that the water content of the fish of the nekton is somewhat less than that of those of the benthos, while the fat content of the former is about three times greater than that of the latter. Further, within each of these groups differences can be shown to exist in the water and fat content ; the less active the species, the more water and the less fat it contains, and *vice versa*. From this, the writer concludes that a correlation exists between the natatory powers and the specific gravity, or fat content,and considers that the fish of the nekton owe their greater swimming capacity not only to their larger swim-bladder, but also to their higher fat content.

51 – **Fur-Farming in Canada.** — *A Report to the Commission of Conservation*, JONES J. W., pp. 159, Ottawa, 1913. OTHER LIVE STOCK.

This report is a manual of fur-farming, giving an account of the history and present extent of the industry, as well as practical details of the ranches on which the different kinds of animals are kept. The preparation of skins for manufacture and the commerce of raw furs are also dealt with.

FARM ENGINEERING.

52 – **Experiments with Meyenburg's Motor Cultivator** (1). — BRETIGNIÈRE, L. in *Journal d'Agriculture Pratique*, Year 77, No. 44, pp. 557-559. Paris, October 30, 1913. AGRICULTURAL MACHINERY AND IMPLEMENTS.

In order to investigate the difference between the work of the plough and of the motor cultivator and its effect upon the crops, parallel experiments with wheat and oats were conducted in the autumn of 1912 at the Agricultural College of Grignon. Both cereals were sown on some plots that had been ploughed and on others that had been worked with the motor cultivator.

The writer gives a short description of the machine and then passes on to the experiments. The wheat was sown after potatoes and at the rate of 178 lbs. per acre, and yielded, per acre, as follows :

(1) See No. 972, *B.* Ang. 1913. (*Ed*).

	Weight of sheaves	Straw	Grain	Chaff
	lbs.	lbs.	lbs.	lbs.
On ploughed land	8 474	* 5 263 (62.1)	2 373 (28.0)	838 (9.9)
On land worked by motor cultivator	8 082	4 888 (60.5)	2 489 (30.7)	705 (8.8)

* The figures in brackets in this and the following tables refer to the percentage of straw, grain and chaff.

On another plot, after carrots for feeding, wheat was sown at the rate of 107 lbs. per acre ; the results were the following :

	Weight of sheaves	Straw	Grain	Chaff
	lbs.	lbs.	lbs.	lbs.
On ploughed land	9 143	5 575 (61.0)	2 877 (31.5)	691 (7,5)
On land worked by motor cultivator	9 143	5 932 (64.9)	2 498 (27.3)	714 (7.8)

The total average per acre was thus :

On ploughed land . . . . . 5 419 lbs. straw and 2 624 lbs. grain
On land worked by motor cultivator . 5 410 » » » 2 493 » »

The difference is too small to justify any conclusion being drawn in favour of the plough.

The second part of the paper deals with experiments made with oats. In experiment I the crop was harvested on August 7, in II in August 8 ; both were threshed soon after.

The results were:

		Weight of sheaves	Straw	Grain	Chaff
		lbs.	lbs.	lbs.	lbs.
I	On ploughed land . . .	6 601	3 960 (60.0)	1 927 (29.2)	714 (10.8)
I	On land worked by motor cultivator	4 460	2 462 (52.2)	1 195 (26.8)	803 (18.0)
II	On ploughed land . . .	5 855	3 690 (63.0)	1 952 (33.3)	213 (3.7)
II	On land worked by motor cultivator	4 086	2 531 (61.9)	1.372 (33.6)	184 (4.5)

In the experiment with oats the difference in favour of the work accomplished by the plough is more marked.

53 – **Motor Plough Trials of the German Agricultural Society at Klein-Wanzleben.** — LICHTENBERGER in *Deutsche Landwirtschaftliche Presse*, Year 40, No. 86, pp. 1027-1029. Berlin, October 25, 1913.

The trials of motor ploughs organized by the German Agricultural Society (" Deutsche Landwirtschafts-Gesellschaft ") extended over a period of nearly two months and consisted of a preliminary trial which lasted seven days' of the trial itself during three days, and of a thirty days' trial of resistance, followed by an eight days' brake test.

Nine outfits were presented ; one of them, Kuers' plough (of Tegel near Berlin), belonged to the double-engine system ; five were tractors hauling the tillage implements attached to them, and the three last were motor ploughs in which the machine and the plough are in one body.

TABLE I.

Plough	Date	Work per hour	Depth of work	Fuel consumed per acre	Cost of fuel per acre	Fuel used
	Aug.	acres	inches	lbs.	*s d*	
Kuers	21.	1.047	10.6	17.53	1–7	Crude benzol
»	22.	1.040	7.5	14.99	1–5	»
I. H. C.	21.	1.784	10.6	27.84	3–2	Citin
»	22.	1.935	7.5	21.86	2–6	»
Universal	21.	0.800	10.6	—	—	Benzol
»	22.	1.278	8.9	22.84	2–11	»
Caterpillar	21.	1.685	11.0	26.41	4–5	Benzine
»	22.	2.180	7.9	18.29	3–0	»
Pöhl (large)	22.	0.988	8.3	33.36	4–3	Benzol
Pöhl (small)	21.	0.680	10.6	34.17	4–4	Benzol
»	22.	0.741	9.1	26.50	3–5	»
Akra	21.	1.354	11.2	23.73	3–0	Benzol
»	22.	1.621	8.7	18.29	2–3	»
Stock	21.	1.606	12.0	24.80	3–1	Benzol
»	22.	1.525	7.5	19.18	2–5	»
W. D.	21.	1.290	10.4	21.28	2–9	Benzol
»	22.	1.389	8.1	19.36	2–6	»

The writer gives some data on the ploughs and reports upon the various trials. In the trial itself all the outfits worked in the same field under conditions as similar as possible and under continuous individual control. Account was kept of the consumption of fuel, lubricants and water, of the area and depth of the work done, etc. Further, the quality of the work and the manner of working were also considered. The results of the two first days of the trial itself are given in Table I.

On the third day of the trial all the machines were submitted to dynamometer tests both when running empty and with a full load; the dynamometers used were self-registering instruments with glycerine filling and mounted on wheels.

The following table contains the data obtained during the thirty days' resistance test:

TABLE II.

Plough	Number of days during which		Area ploughed			
			Depth			
	the plough could work	the plough did work	less than 7 ½ inches	7 ½ to 10 ¼ inches	more than 10 ¼ inches	Total
			acres	acres	acres	acres
Kuers	33	31	81.5	—	228.8	310.3
I. H. C.	33	32	73.8	202.4	154.7	430.9
Universal	35	26	156.5	—	86.8	243.3
Caterpillar	33	33	133.5	46.5	314.3	494.3
Pöhl (small)	—	—	60.1	8.7	—	68.8
Akra	33	25	—	330.8	—	330.8
Stock	35	34	194.7	—	117.8	312.5
W. D.	32	31 ½	83.3	152.3	54.2	289.8

54 – **Maillet's Motor Tilling Machine.** — *Le Génie Rural*, Year 5, No. 47-48, pp. 5-6. Paris, June-July 1913.

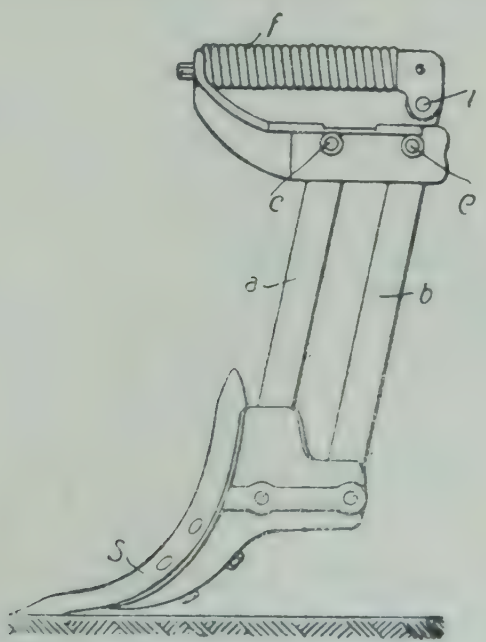
This is a description with illustration of a motor tilling machine which is characterized by the tilling implement being screw-shaped. A small motor causes the screw to revolve. The surface of the screw turns a furrow slice over like a mouldboard would do. The diameter and the pitch of the screw depend upon the kind of work in hand. The depth of the work can be adjusted. The steering is accomplished by means of two handles fixed at the back of the machine, which is mounted on two wheels, and has been designed for use in vineyards.

55 – **Trial of a "Universal" Spring-Tooth Cultivator.** (8th Report of the Station for the Testing of Agricultural Machines and Implements at Hanover). — NACHTWEH, A. in *Mitteilungen des Verbandes landwirtschaftl. Maschinen-Prüfungs- Anstalten*, Year 7, Part 3, pp. 89-92. Berlin, 1913.

This "Universal" cultivator was handed over in the spring of 1910 to the Station for testing agricultural machines and implements at Hanover for trial. It was sent to the Gleidinger estate near Hanover and regularly used in the farming operations of the estate in spring and autumn.

The writer gives a detailed description of the implement, in which the device for regulating the depth of work is new. It consists o an endless screw with crank handle mounted on a support fixed at right angles to the axle of the rear wheels. A further novelty is an angle lever, which forms an adjustable connection between the intermediate frame and the pivoting fore-carriage, by means of which, and by turning the above-mentioned crank handle, the implement can be adjusted simultaneously in front and behind to the required depth, even while working in heavy ground and without stopping the team.

Another new feature is the build and arrangement of the teeth, which are patented in Germany (No. 223 716). One of them is shown in the adjoining figure.



It consists of two parallel iron bars, *a*, *b*, fastened to specially formed cross pieces, *c*. The rear bar, *b*, is prolonged above the cross piece and connected by a bolt, *i*, with a strong rod bearing round it a spiral spring, *f*, which takes up and deadens the shocks that the tooth *S* encounters while working.

The writer gives, in the form of a table, the measures and the prices of the different sizes in which the cultivator is built, and also the number of draught animals required for each.

The conclusion drawn from a long-continued test is that this cultivator is a practical implement, suitably constructed for its work, which it performs in a satisfactory manner.

56 – **Spring-Tooth Harrows.** — RINGELMANN, M. in *Journal d'Agriculture Pratique*, Year 77, No. 39, pp. 408-410. Paris, September 25, 1913.

The writer begins by the following results of observations made with three rigid harrows with vertical teeth:

	Harrows A	Harrows B	Harrows C
Effective breadth of tooth	0.71 in.	0.82 in.	0.98 in.
Average distance between the teeth measured at right angles to the direction of draught	1.69 in.	2.36 in.	1.77 in.
Average weight of each tooth	4.4 lbs.	4.2 lbs.	4.6 lbs.
Depth of work done	1 3/4 in.	2 in.	2 in.
Average traction power per tooth	4.84 lbs.	9.02 lbs.	11.44 lbs.
Average traction power per tooth and inch of depth	2.8 lbs.	4.5 lbs.	5.6 lbs.

He then gives the data obtained by experiments made with three spring-tooth harrows on the same day and in the same field as the three preceding harrows:

	Harrows E	Harrows F	Harrows G
Effective breadth of teeth	2.17 in.	2.17 in.	1.89 in.
Average distance between the teeth measured at right angles to the direction of draught	3.94 in.	3.94 in.	4.09 in.
Average weight per tooth	15.6 lbs.	15.6 lbs.	17.6 lbs.
Depth of work done	2 3/4 in.	3 1/4 in.	3 1/2 in.
Average traction power per tooth	69.3 lbs.	85.8 lbs.	44.6 lbs.
Average traction power per tooth and inch of depth	25.2 lbs.	27.4 lbs.	12.9 lbs.

From the above results the writer concludes that with an average of 1.2 inch breadth of tooth and a distance of 2.4 inches between the tines, a greater depth of work can be attained with spring-tooth harrows without increase of traction power.

57 – **Threshing with Steam Engine or with Electric Motor.** — TIETZ, P. in *Deutsche Landwirtschaftliche Presse*, Year 40, Nos. 82 and 83, pp. 979-981 and 995-997. Berlin, October 11 and 15, 1913.

In order to obtain reliable data on the economic difference between these two systems of producing power, the Magdeburg Steam Boiler Association ("Magdeburger Verein für Dampfkesselbetrieb") carried out in February and March 1913 extensive comparative experiments in two farms. The

writer gives data on the machines used, on the loss of grain, on the consumption of fuel, etc.

In the second part of the paper the general pros and cons of the two power systems are discussed, and with the aid of two tables the costs of electric and steam threshing are compared. These experiments show that the alleged superiority of electric threshing as to cleaner and cheaper work does not correspond to reality.

58 – **Trial of a Roller Mill.** (41st Report of the Machine Testing Station of the Chamber of Agriculture for the Province of Brandenburg). — FISCHER, G. in *Mitteilungen des Verbandes landwirtschaftl. Maschinen Prüfungs-Anstalten*, Year 7, Part 4, pp. 153-161. Berlin, 1913.

The machine was submitted to a series of tests on April 23 at the Agricultural College in Berlin and then entrusted to the Hobrechtsfeld farm in the neighbourhood of Berlin and belonging to it, for the trial of resistance.

The writer gives a detailed description of the machine and of its working.

A cast iron support bears the hopper and the feeding device (see fig. 1). The milling rollers are enclosed in a cast iron case resting on a strong frame. Fig. 2 shows a section through the mill.

Its price is about £42 10 *s*.

A report of the trial is given and the data obtained are grouped in the following table.

No. of trial	Date	Grain ground	Duration of trial		Performance	Power required	Number of revolutions per minute	Degree of fineness of product	Kind of groats	Performance per hour	Performance per HP.-hour
			Min.	Secs.	lbs.			> 3 : > 2 : > 1 : < 1 mm.		lbs.	lbs.
1	23.4.13	Barley	4	56	202	10.87	408	3:8:68:21	medium	2462	227
2	»	»	2	25	173	10.50	423	8:25:54:13	»	4290	409
3	»	Ma ze	5	11	389	11.35	411	—	—	4497	396
4	»	Rye	1	50	183	11.52	417	4:44.5:37.5:14	coarse	5997	521
5	23.6.13	»	49	40	4565	11.00	419	19.5:39.5:29.5:11.5	»	5386	491
6	»	Barley	46	30	3496	11.75	415	15:32:40:13	medium	4510	385
7	»	»	2	50	117	10.90	416	4.5:7.5:36:52	fine	2468	226
8	20.9.13	Rye	50	30	5392	13.05	420	11.5:41.5:34.5:12.5	coarse	6406	493
9	»	Barley	30	00	2424	11.70	420	20:34:35:11	medium	4849	414
10	»	Maize	9	00	1485	8.85	421	75:15:7.5:2.5	crushed	9900	1118
11	»	»	4	35	234	12.35	419	0.5:9:61.5:29	medium	3067	249

The final judgment on the mill was as follows: It is simple and suitably constructed in all its parts, and is easy and safe to handle. The output is considerable and the amount of power it requires, considering the output and its degree of fineness, is very low. The mill is suitable for the

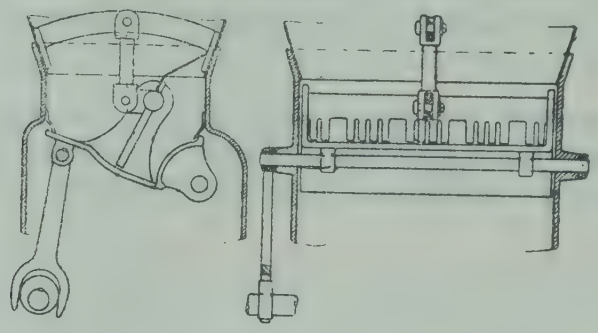


Fig. 1. — Hopper and feeding device.

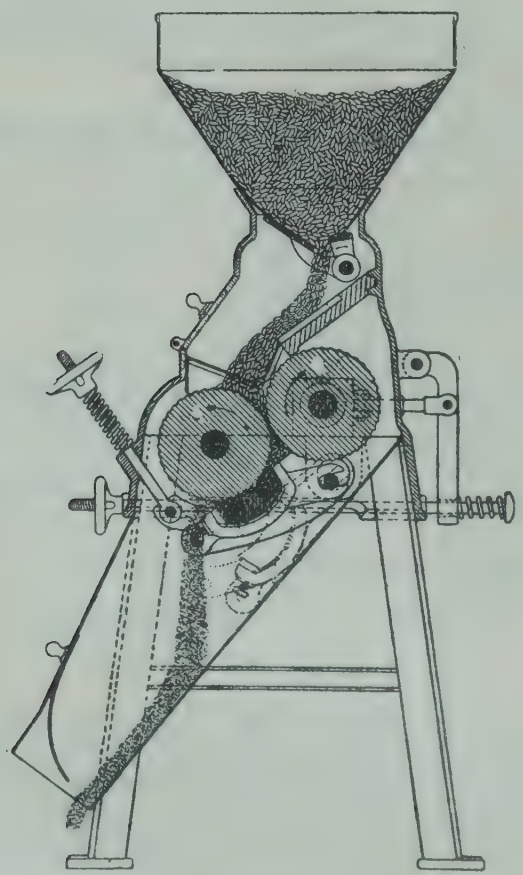


Fig. 2. — Section of roller-mill.

production of groats of the degree of fineness most required in practice, and the product is good and cool. The feeding device and the case round the rollers are remarkable and practically important innovations in the construction of agricultural mills. The durability of the mill, according to the trial of resistance, is great.

59 – **Review of Patents.**

Tillage implements and machines.

266 626 (Germany). Turn-wrest plough with shares that can turn round the beam.
266 627 (Germany). Motor tilling machine with hydraulic lifter for the tilling implements.
266 752 (Germany). Motor power plough with driving wheels driven by differential gear, and fitted with special steering wheel.
62 531 (Austria). Motor plough consisting of hauling motor and plough chariot.
62 584 (Austria). Portable cultivator with implement shaft driven by motor and placed behind the driving wheels.
62 852 (Austria). Motor plough.
59 897 (Hungary). Soil tilling machine with implements mounted on a drum.
59 804 (Hungary). Turn-wrest plough.
60 182 (Hungary). Motor plough.
255 592 (Belgium). Motor plough.
254 232 (Belgium). Turn-wrest plough.
254 832 (Belgium). Traction engine for ploughs and other agricultural implements.
1 076 752 (United States). Plough.
1 075 410 (United States). Disk-cultivator.
1 076 520 (United States). Combined plough and harrow.
459 039 (France). Machine for tilling the soil.
459 302 (France). Improvement in ploughs driven by motor.
459 211 (France). Harrow with rotating teeth.
303 (United Kingdom). Motor-driven cultivator.
20 524 (United Kingdom). Plough.
3 966 (United Kingdom). Oscillating plough.
135 282 (Italy). Improvements in soil tilling implements hauled by cables.
134 816 (Italy). Ploughing machine.

RURAL ECONOMICS.

60 – **Some Profitable and Unprofitable Farms in New Hampshire.** — ROBERTSON, FRED. E. and DODGE, LAWRENCE G. in *U. S. Department of Agriculture, Bureau of Plant Industry, Circular* No. 123, pp. 3-15. Washington, May 24, 1913.

RURAL ECONOMICS.

The New Hampshire College Agricultural Experiment Station, together with the Bureau of Plant Industry, U. S. Department of Agriculture, investigated the working and profitableness of 428 farms in the State of New Hampshire. The results of these investigations are given and discussed by the writers in this paper. They compare the averages of the group of 100 profitable farms with those of 100 of the least profitable ones, and from the comparison draw conclusions as to the causes of the great difference in economic success, as is shown by the following table :

	100 better farms	100 poorer farms	Average: 428 farms
	$	$	$
Receipts	2 318	991	1 439
Expenses	1 083	792	796
Net income	1 235	139	643
Interest on investment, 5 %	360	348	308
Family labour	53	130	70
Labour income	830	— 341	266

The average areas of all the 428 farms of which data were obtained are the following:

	100 better farms	100 poorer farms	Average: 428 farms
	acres	acres	acres
Tillable	50	44	43.2
Pasture	130	100	99.8
Woodland	23	29	30.5
Total	203	182	173.5

The difference in acreage is slight; the group of better farms has an average of only 21 acres more land per farm than the poorer group and only 6 acres more of tillable land. When it is considered that the labour income of the farmers on the better farms averages $830 and that those farmers on the poorer farms have a minus labour income averaging $341, the small difference in acreage does not seem to offer an adequate explanation for the great difference in income.

When these same 200 farms are redivided on the basis of tillable acreage, the 100 having the largest tillable acreage have an average labour income of $341, while the 100 with the smallest tillable acreage have an average of $190. This would indicate that acreage is certainly one factor that counts in determining the labour income, though not enough to explain the above-mentioned great difference.

The writers then compare the distribution of capital in the two groups:

	100 better farms	100 poorer farms	Average: 428 farms
	$	$	$
Machinery and tools	453	351	352
Real estate	4 864	5 332	4 404
Live stock	1 592	1 045	1 152
Grain and feed	145	106	106
Cash to run business	163	144	137
Total	7 217	6 978	6 151

The difference of $239 per farm is so small as to offer no reason for any great difference of earning power between the two groups.

A marked difference exists, however, between the two groups in the distribution of the capital. The better farms have 32.6 per cent. of their total capital as working capital and the poorer have only 23.5 per cent. as such. This unfavourable condition is often due to having relatively too much capital in buildings.

The receipts from the better farms exceed those of the poorer by 149 per cent., as is shown by the following table:

	100 better farms	100 poorer farms	Average: 428 farms
	$	$	$
Crop sales	347	136	262
Net live stock sales	260	121	162
Sale of stock products	1 389	612	814
Increased inventory	184	30	110
Outside labour	138	32	91
Total receipts	2 318	931	1 439

The greater success of the farmers belonging to the first group is not caused by an absolute saving of expenses, because their average expenses

are $291 or 36.7 per cent. greater than on the poorer farms, as the following table shows :

	100 better farms	100 poorer farms	Average: 428 farms
	$	$	$
Hire of labour	250	181	173
Board of labour	76	74	59
Seeds	21	14	15
Fertilizers	64	37	40
Hay	17	11	15
Feed and grains	398	258	284
Machinery	45	22	28
Buildings and repairs	46	40	40
Silo filling	11	6	8
Horse-shoeing	24	20	20
Milk hauling	11	11	8
Taxes	73	78	66
Other expenses	38	40	40
Total	1 083	792	796

The success of the better farmers is due to more and better crops and more productive herds, which in their turn are due to a more efficient use of land and time.

The writers also give tables comparing the conditions and incomes of two characteristic farms of the first group and one of the second, which lead to the same conclusions.

61 – **The Private Economic Conditions of Moravian Peasant Farmers.** — Communication of the Book-keeping and Farming Department of the German Section of the Moravian Agricultural Council, in *Zentralblatt für Landwirtschaft*, Year 93, No. 22, pp. 253-255. Brünn, November 16, 1913.

The data obtained from 79 Moravian peasant farms show that, without considering debts or other burthens, the average income per acre is £2 15*s* 8*d*, of which £2 7*s* 7*d* (85.4 per cent.) is derived from the farm itself, 2*s* (3.7 per cent.) from accessory industries, and 6*s* 1*d* (10.9 per cent.) from other sources. The average extent of the farms being 73.66 acres, the average yearly income of the 79 farms is the following :

Income of Debt-free Properties.

	Group	Average extent of farm: acres	Altogether: from farm itself	Altogether: from accessory industries	Altogether: from other sources	Altogether: Total	Per acre: from farm itself	Per acre: from accessory industries	Per acre: from other sources	Per acre: Total	In percentages: from farm itself	In percentages: from accessory industrles	In percentages: from other sources	In percentages: Total
			£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	s. d.	s. d.	£ s. d.				
Influence of natnral conditions	I	71.79	221 11 1	13 6 9	70 7 10	305 5 8	3 1 9	3 8	18 3	4 3 8	73.8	4.4	21.8	100
	II	75.57	164 8 4	3 5 10	15 5 11	183 0 1	2 3 6	1 0	4 0	2 8 6	89.5	2.0	8.5	100
	III	70.06	164 4 2	13 0 1	7 1 8	184 5 11	2 6 11	3 8	2 0	2 12 7	89.2	7.0	3.8	100
Influence of economic conditions	I	48.80	84 15 5	12 6 9	6 11 9	103 13 11	1 14 9	5 1	2 8	2 2 6	81.7	11.9	6.4	100
	II	81.27	163 2 6	16 9 3	13 0 11	192 12 8	2 0 2	4 0	2 8	2 6 10	85.7	8.6	5.7	100
	III	58.44	158 14 2	1 19 2	25 12 6	186 5 10	2 14 4	0 8	8 9	3 3 9	85.1	1.1	13.8	100
	IV	96.45	172 5 0	3 5 0	17 17 7	193 7 7	2 13 8	0 8	3 8	2 18 0	92.4	1.1	6.5	100
Influence of extent of farm	I	223.88	336 0 10	3 15 10	15 1 9	354 18 5	1 10 0	0 4	1 4	1 11 8	94.6	1.0	4.4	100
	II	108.11	240 13 8	14 11 9	25 11 0	280 16 5	2 4 6	2 8	4 9	2 11 11	85.7	5.1	9.2	100
	III	69.76	139 19 10	1 3 4	20 0 1	161 3 3	2 0 2	0 4	5 9	2 6 3	86.8	0.7	12.5	100
	IV	49.05	154 14 1	6 12 6	26 9 4	187 15 11	3 3 1	2 8	10 9	3 16 6	82.3	3.5	14.2	100
	V	25.49	56 7 9	4 15 10	5 5 0	66 8 7	2 3 6	3 8	4 0	2 11 2	84.8	7.2	18.0	100

	£	s	d
Income from the farm itself	175	3	6
Income from accessory industries	7	9	1
Income from other sources	22	7	3
Total	204	19	10

The amount of the income from the farm itself diminishes as the natural and economic situations become less favourable, as well as with a decrease of acreage. The proportion of the income of the farm itself to the total income becomes greater the more unfavourable the natural position of the farm and the more favourable its economic situation; it becomes smaller the smaller the farm, for as the latter does not afford the owner sufficient income, he is obliged to have recourse to other sources to eke out his means of living. It appears however from the annexed table: "Incomes of debt-free properties," that the principal occupation of the owners of all the farms examined is agricultural, for in all the groups the income from the farming proper is by far the largest item of the total income, so that all the other sources of revenue are to be considered as auxiliary.

The average net income from the farm (£2 7*s* 7*d* per acre) bears, on the average of the 79 farms, a burthen of 6*s* 1*d* (12.7 per cent.) interest on debts and 4*s* 0½*d* (8.5 per cent.) servitudes in kind, together 10*s* 1 ½*d* (or 21.2 per cent.). Only 16 out of the 79 farms (or 20.2 per cent.) are free from debts and only 39 (or 49.3 per cent.) are free from servitudes in kind.

The amount of the debts is not influenced by the natural and economic conditions of production, though on going from the plains towards the mountains a decrease of the amount of servitudes is noticeable. The same is observed with the improvement of economic situation.

The average net income of £2 7*s* 7*d*, together with £3 2*s* 6*d* a month as remuneration for the farmer's labour, works out at an interest of 1.89 per cent. on the capital. The average indebtedness of the 79 farms amounts to £6.9*s* 2*d* per acre (on a land value of £34 4*s* 1*d* per acre). The interest on the farming debts is about 4.7 per cent ; compared with the interest on the capital, namely 1.89 per cent., this is a high rate of interest and diminishes the farmer's share of the net profit to a a considerable extent. From the calculation of averages it appears that the rate of interest (1.89 per cent.) on debt-free farms is reduced to 1.33 per cent. by the servitudes, to 1.27 per cent. by debts and to 0.5 per cent. by both together.

62 – **Farming Conditions in the Department of Puy-de-Dôme, France.** — Augé-Laribé, Michel in *La Vie agricole et rurale*, Year 4, No. 46, pp. 497-501. Paris, October 1913.

Division of the country into agricultural belts according to altitude above sea-level ; acreage devoted to the principal crops ; characteristic of the agriculture of the regions in the extension of forage crops: with less than 495 000 acres under cereals there are upwards of 741 000 acres of forage crops. The increase of acreage and of yield per unit of area of the most exacting cereals (wheat, oats and barley) are evidence of progress in farming

since 1892. From that year to 1911 the area under vineyards sank from 109 274 to 57 601 acres, whilst the area devoted to field forage-plants rose from 135 910 acres to 148 265, and that under meadows and pastures from 452 210 acres to 625 180. Fruit-growing and market gardening are steadily extending.

The number of horses rose from 15 500 in 1892 to 18 500 in 1911, that of mules from 499 to 830 and that of asses from 3805 to 6300, while the number of sheep fell by about 100 000 head. The breeding of cattle has developed greatly. In the mountains dairying (butter and cheese making) prevails, while on the plateaus and in the valleys cattle are more used as draught animals, the cows also being harnessed.

The subdivision of land has been carried far and represents one of the greatest obstacles to the further introduction of improved methods of farming : small farms (under 25 acres) are prevalent and the fields composing them are frequently at a distance from each other. The land is mostly farmed by the owners themselves; it is seldom rented and only exceptionally worked on the share system. Only by a greater development of cooperation and by untiring agricultural education in the country will farming be able to make further progress under existing conditions.

63 – **The Profitableness of Milk Farms.** (1). — Auf dem Thie, Hermann in *Archiv für exakte Wirtschaftsforschung*, Supplement 11, pp. 1-99. Jena, 1911.

The author seeks to establish the individual factors of the profits made by milk farms under various conditions, availing himself of the data obtained by book-keeping, partly taken directly, partly from the literature on the subject. After some preliminary observations on the conflicting opinions found in the above literature on the profitableness and the importance to public economy of this system of keeping milch cattle, the writer discusses the methods for ascertaining the profitableness of a branch of farming in general, and of keeping milch-cattle in particular, the calculation of the cost of milk production, and the determination of the utilization of the forage used. He then investigates, with the aid of tables, which contain the individual results of his calculations, the effect of the several factors upon the profits of milk farms.

The fodder consumed by individual animals and by various herds is utilized by them very variously as regards both the production of milk and the increase of live weight ; as the better performance, in so far as it depends upon the nature of the animals, is, under certain conditions, available free of expense, the increase in the capacity of producing is an important factor of profit; on the other hand, the high price that is paid for highly productive animals often counterbalances the advantages of a good utilization of fodder.

The loss on selling cows may be distributed over a longer period by feeding to keep up the milk yield when the cow would naturally be drying off ;

(1) German « Abmelkbetrieb », *i. e.* when the cows are bought in, milked once, and sold off again. (*Ed*).

but if the cost of the extra concentrated food exceeds the value of the extra milk obtained, the utilization value of the home-grown produce will be reduced, and to an extent varying with the proportion of purchased food fed and the difference between its price and utilization value. When the purchase price is above the utilization value, the number of cows must depend on the amount of forage produced on the farm. If, however, the utilization value is greater than the purchase price, milk production may profitably become a purely industrial undertaking depending entirely on purchased food.

The amount of the milk yield in exclusive milk farms has not generally the decisive influence upon the profitableness that it has in other dairy farms. With the yield of milk, expenses increase also, especially those for concentrated foods, while the cost of labour and general expenses are not influenced to any great extent. Increased expenditure with the object of attaining a high milk yield is all the more justified the higher the price of milk, because the great influence which this has on the profits of the milk farm is felt increasingly with augmenting milk yield. The profit realized upon the milk depends upon the economic position of the farm, and the consequent manner of utilizing the milk. The best utilization of milk is by direct disposal to private customers; no doubt the expenses entailed by selling the milk in this way are often high enough, but they do not reach the trade profit of the milk merchant and the expenses of the dairies that collect milk from the producers. Selling the milk to dairies that make butter, and working up the milk in the farm itself, are in general the least profitable ways of utilizing milk.

The general expenses and those for labour and teams make up a great part of the total outlay and weigh all the heavier the lower the price of the milk and the lower the milk yield, as they do not depend upon these factors.

The average cost of labour per cow per annum is about £3, the general expenses about £1 10*s*, while the expenses for team work, which are lower, vary considerably according to the economic position of the farm. Of special importance for the profitableness of the keeping of milch cows is the work of the stable hands. By improper feeding, bad milking and careless treatment, many losses may be incurred. The wages must be so arranged that the profits of the attendants coincide with the interest of their employers (rewards on a sliding scale).

The difference between the buying-in price and selling-off price of the cows has also a great influence on the profit of milk farms. It determines the extent and the character of the milk farm. If the buying-in price of the unit of weight is lower than the selling-off price, the quickest turning over of the capital in cows is, from the point of view of private economy, the most profitable. But there are few farms which realize such a profit on the animals; most farms must put up with a loss of live-weight, which is frequently considerable. In one of the farms examined, this loss amounted to £8 6*s* per cow per annum. As a consequence, the present tendency is towards keeping the cows longer and allowing the best to calve again in the

farm (Halbabmelkbetrieb). By their staying longer, the loss in live-weight is spread over a longer period and partly balanced by the sale of the calves. The feeding, also, is less intensive in these farms, many of the more expensive foods being saved. The consequent diminution of expenses is not, in most cases, set off by a smaller quantity of milk being sold. In this system, also, the injury caused by the exclusive milk-farms to public economy, by selling milch-cows prematurely to the butcher, is not so great, and frequently the best calves get sold to breeders instead of to the butchers.

The question whether exclusive milk-farming is economically the best way of keeping milch-cows, and how the farms are to be arranged and managed in order to yield the greatest profit, cannot be answered without careful examination of all the factors contributing to the net profit, generalizations of only a few figures being often misleading.

AGRICULTURAL INDUSTRIES.

64 – **Summary of the Results of Researches made during the Last Few Years at the Dairy Institute at Alnarp (Sweden), by L. F. Rosengren.** — *Communication by the Official Correspondent of Sweden to the International Institute of Agriculture.* DAIRYING.

I. *Fat content of skimmed whey.* — If whey is submitted to a violent motion, such as, for instance, working in a churn for 30 minutes at a temperature of 50° C. (122° F.), the cream cannot afterwards be separated to the same degree as if it had not been so treated. Thus the writer found that whey containing 0.305 per cent. of fat was reduced by separating without previous churning to a fat content of 0.035 per cent., whilst when churned before separating it was reduced to only 0.235 per cent. This result agrees with that obtained in M. Barthel's experiments on separating (*Revue générale du lait, III*, p. 25).

Whilst the determination of the fat content according to Röse-Gottlieb's method gives higher results than when Adams' method is followed, the difference becomes still greater if the milk has been worked before skimming. M. Barthel has shown that this difference does not appear on examining the whey. This fact confirms the hypothesis of M. Weibull that in drying the milk according to Adamas' method, the smallest globules of fat are enclosed in the casein, so that they are inaccessible to dissolution in ether (*Lantbruksakademiens Handlingar och Tidskrift*, 1898, p. 3).

This higher fat content obtained by Röse-Gottlieb's method, cannot, on the other hand, result from the dissolution of gelatinous membranes in the ether and benzine mixture, as M. Storh supposed (36 *Beretning frå K. Vet. og Lundbohöisk. Lab. f. Landoekön. Forsog*, 1897, p. 87), since the quantity of matter not fat dissolved by the above mixture is too insignificant to be able to exert any notable influence on the results of the analysis, and besides it does not consist of gelatinous membranes, but of lecithin or of products of its decomposition. (ROSENGREN, L. F. « Gottlieb ou Adams » *Revue gènérale du lait* III, 1904).

2. *The fat content of skimmed milk in connection with the progress of lactation.* — The writer has demonstrated that there is a considerable difference in the degree to which milk is capable of separation at the different periods of lactation. Accordingly as the milk came from cows near the end of the lactation or from cows that had recently calved or was a mixture of these two kinds of milk, it contained the following amounts of fat:

Temperature of separating	Milk of cows drying off	Milk of cows recently calved	Mixed milk
	per cent.	per cent.	per cent.
30° C (86° F.).	0.235	0.12	0.18
40° C (104° F.).	0.196	0.11	0.17
60° C (140° F.).	0.145	0.098	0.12

(ROSENGREN, L. F. *Tidskrift för Landtmän*, 1903, p. 209.)

3. *Value of Weibull's method for the determination of the fat content of cream.* — Weibull's method, according to which the fat content is determined on the dried cream, may be advantageously employed in dairies with the aid of the balances used to determine the amount of water present in butter. Provided it is certain that the cream has not been watered, the method, which is rapid and sure, lends itself especially to the control of the fat content of cream sold directly from the dairy. (ROSENGREN, L. F. *Landtbr. Akademiens Handl. och Tidskr.*, 1910, p. 71).

4. *The ordinary method for determining the amount of impurities* in the milk is probably weighing the sediment obtained by various means from a certain quantity of milk. Considering that in this sediment there is a fairly considerable quantity of the undissolved salts of the milk, the figures representing the impurities are too high, if the sediment before being dried and weighed has not been treated, for instance, by a weak solution of hydrochloric acid. (ROSENGREN, Ulanderska mjölkrenaren.—*Meddelande* No. 8 *från Maskin och Redskapsprofningarna*).

5. *Ripening of the cream at low temperatures.*— In 1899 the so-called fermentation at a low temperature, about 10-12° C. (50 to 54° F.) was introduced into the Alnarp dairy and then gradually into most of the Swedish dairies. If the cream has been pasteurized and then cooled to this point, its temperature will rise again by some degrees during ripening, independently of the surrounding temperature, so that it becomes suitable for churning.

By this method of ripening, a saving of labour and of refrigerators is effected in comparison with ordinary ripening at a higher temperature, which necessitates a cooling of the cream before churning. At the same time the danger of carrying acidification too far is avoided. The lactic ferments employed for the ripening of cream develop at a temperature as low as 9 to 10° C. (48 to 50° F.), and fast enough to allow cream to which 5 to 10 per cent. of ferment has been added and which has been stirred from time to time during the first hours, to be ready for churning within 18 or 20 hours (ROSENGREN, L. F. *Berättelse öfver Svenska Smörprofningarna år* 1900).

6. *Keeping the lactic ferment.* — Among the most effective measures to keep a culture of lactic ferment which will be employed for ripening cream

the very frequent stirring of the culture after transplanting it into some pasteurized skimmed milk must especially be mentioned, as it renders the development of the lactic acid bacteria more active and forms the best defence against injurious micro-organisms. When the conditions favourable to the development of the ferment have ceased or the milk has curdled, the culture of the ferment must be considerably cooled. (ROSENGREEN, L. F. *Berättelse öfver Svenska Smörprofningarna*, 1898).

7. *Influence of a too acid ferment on the butter.* — A very common defect of butter, which depreciates it greatly, is the taste of malt. In examining the conditions under which this taste appears, the writer has found that it is caused by the prevalence of the lactobacilli over the streptococci in the ferment used to ripen the cream. His researches have demonstrated that the development of the lactobacilli is promoted by the strong acidification of the milk, which does not suit the streptococci. If the ferment is allowed to become too acid several times before it is sown into the pasteurized milk, the lactobacilli predominate more and more over the streptococci and are besides generally accompanied by yeasts. The use of such a vitiated ferment to start the ripening of the cream causes, according to the researches of the writer, the above-mentioned defect in the butter. (ROSENGREN, L. F. in *Landtbr. Akademiens Handl. och Tidskr.*, 1911, p. 596).

8. *The water content of butter* depends, according to the writer's investigations, upon the following circumstances:

a) The content in water increases as the working up becomes more energetic; the greater the speed of the roller of the butter-worker the more continuous the work and the more the butter passes between the rollers in large lumps. It diminishes if the butter is worked in small masses and if an interruption of the work allows the brine to escape.

b) The water content diminishes, the firmer the butter when it is worked up.

c) The degree of moisture in the butter when placed on the worker; the higher this is the more water will the butter contain.

d) The adhesiveness of the liquid in the worked butter increases its retention by the butter; consequently an unwashed or a badly washed butter will contain more water than a well washed one.

e) Acid butter retains more water than a butter churned from sweet cream.

f) The addition of salt favours the draining of the water.

g) The draining off of the liquid is easier the larger the granules of butter, a butter consisting of small granules retaining water like a sponge. (ROSENGREN, L. F. *Berättelse öfver Svenska Smörprofningarna*, 1902, 1907).

9. *Influence of various kinds of concentrated foods on the butter.* — Soya cake has been used in amounts reaching 5 ½ lbs. per head per day without communicatng any special taste to the butter or in any way lowering its quality. (ROSENGREN, L. F. *Landtbruksakademiens Handl. och Tidskr.*).

Sesame cake has proved equal to earthnut cake as regards its influence on butter. (ROSENGREN, L. F. *Landtbruksakad. Handl. och Tidskr.*).

Peas, beans and vetches, of which as much as 8 ¾ lbs. per head per day have been included in a normal feeding ration, have not had any injurious action on the quality of the butter; they may in this respect be put on the same level as ordinary feeding cakes. Thus the experiments made have given no support to the wide-spread opinion that pulse imparts to the butter an inferior taste. (ROSENGREN, L. F. *Landtbruksakad. Handl. och Tidskr.*, 1912, p. 592).

10. *Refrigeration of butter.* — In order to keep the butter good for the weekly exportations refrigerating safes are used for storing the barrels. The writer has made some experiments on the cunsumption of ice and the changes of temperature in such a safe built with double wooden walls about 3 inches apart and containing 300 to 350 lbs. of ice and holding four barrels of butter. He caused it to be filled with ice the first day and did not have any more ice added during the seven days that the experiment lasted. During this time the average temperature kept at 6.3° C. (43.3° F.), varying from 6° to 6.9° C. (42.8° to 44.4° F.), the outer temperature being 21.2° C. (70.2° F.). The consumption of ice was 0.16 kg. per cubic metre and per degree of difference between the inner and the outer temperatures (0.005 lb. of ice per cubic foot per 1° F.).

When the insulating material (well rammed chaff), was removed, leaving only air insulation, the consumption of ice rose to 0.30 kg., that is to say almost double.

When the ice was mixed with 5 per cent. of salt, the inside temperature of the safe sank to below freezing point.

The temperature of the butter in the barrels sank from 16° C. (60.8° F.) to 14.5° C. (58.1° F.) the first day, to 11.6° C (52.9° F.) the second, to 10.6° C. (51.1° F.) the third, and to 10.3° C. (50.5° F.) the fourth day, the temperature in the inside of the safe being in this case 7.3° C. (45.1° F.) (ROSENGREN, L. F. *Berättelse öfver Svenska Smörprofningarna*, 1905).

11. *Control of the purity of the water used for washing the butter, in regard to salts of iron.* — In order to avoid the injurious influences of the salts of iron on the quality of the butter, the water used for washing it must not reveal the presence of iron when tested with potassium sulphocyanate. The examination is made, according to the writer, as follows: 20 c. c. of water are boiled in a test-tube after the addition of a few drops of bromine water; a few drops of hydrochloric acid and 1 to 2 c. c. of a solution of potassium sulphocyanate are then added, the mixture is shaken and mixed with 5 c. c. of ether and again shaken. The ether, on separating out from the aqueous solution, must not be sensibly coloured by the iron sulphocyanate. (ROSENGREN, L. F. *Berättelse från Alnarps Landtbruks-och Mejeriinstitut*, 1909).

12. *Use of cultures of lactic ferments in cheese making.* — Since 1899 cultures of lactic ferments have been used in the Alnarp dairy for the preparation of various kinds of cheeses. These cultures consist of the common lactic ferment, *Streptococcus lacticus*. The intense feeding of the cows, leading to the production of a milk less suitable for cheese-making, has rendered the use of cultures of lactic ferments absolutely necessary for the successful manufacture of cheeses of a uniform character.

Cultures of lactic ferments are employed with good results in a great number of Swedish dairies. In 1902 experiments were begun with the bacillus Σ Freudenreich, and they have confirmed the opinion of v. Freudenreich and d'Orla Jensen on the importance of these organisms for the manufacture of cheeses of the Emmenthal type.

13. *Coating cheeses with paraffin.* — Since 1905 all kinds of hard cheeses made at the Alnarp dairy have been coated with paraffin. Experience has shown the utility of this treatment, the success of which, however, depends upon various circumstances. The temperature of the paraffin bath into which the cheeses are plunged must not be inferior to 130° C. (266° F.) and the cheese must be well cleaned, dry and not acid, because acidity leads generally to the exudation of moisture which detaches the paraffin coat.

The coating must be renewed as soon as the previous coat cracks or gets otherwise spoiled.

It may be estimated that the usual loss of weight during storage is diminished by about 10 per cent. by this treatment. The quality of the cheese is improved and the deterioration of cheese due to mites and moulds is avoided ; at the same time the work of handling the cheese in the store house is lightened.

65 – **Determination of the Amount of Water added to Milk based on the Degree of Acidity.** — Gerö, Vilmos in *Kisérletügyi Közlemények*, Year XVI, Part 5, pp. 663-664. Budapest, September-October 1913.

Among the available means for determining the amount of watering to which milk has been subjected, the specific gravity of the serum and the refraction are undoubtedly the most trustworthy. The other analytical factors should correspond, but they are often liable to oscillations. It is also impossible to found a sure judgment on the ash content, especially when the milk has been adulterated with well-water containing much mineral matter.

In order to determine the degree of freshness of the milk, especially in summer, the writer has determined its acidity by Thörner's method ; he observed that the acidity of watered milk is much below that of pure milk. In Hungary the amount of acidity of the milk on sale varies between 17 and 22°, whilst milk adulterated with water shows less than 15°, and when much water has been added, the acidity sinks to 13, 12 and even 10°.

In support of the above, the writer shows in the following table the results of some analyses of milks made in the year 1909, which was a year in which adulteration was frequent.

Of course, the degree of acidity, like the other factors, has not an absolute value and it may happen sometimes that watered milk marks 15° and even more, while fresh milk submitted immediately to analysis marks some degree below normal (15°). Nevertheless this has never been observed when the samples were taken on the market.

In summer, when the process of acidification is more rapid, it might be believed that the acidity of adulterated milk would be high ; whereas in reality such is not the case, because the acidification of adulterated milk

Number	Specific grav ty	Fat	Total solids	S. G. of serum	Nitrate reaction	Degree of acidity
4	1.0252	4.4	11.83	1.0208	strong	10.0
8	1.0270	3.1	10.72	1.0226	strong	12.0
21	1.0240	2.8	9.60	1.0205	strong	10.5
22	1.0219	2.65	8.71	1.0190	weak	9.0
35	1.0240	3.7	10.68	1.0190	strong	10.0

is slow. This same fact is also been observed in the preparation of curdled milk : normal or skimmed milk curdles rapidly, whilst the coagulation of watered milk lasts twice or thrice as long. The result of all these obser vations is that if the degree of acidity is minimal and it agrees with the other data it may serve as a basis for the valuation of the milk.

66 – **The Relationship between the Bacterial Flora of Milk and of the Pasture.** — WOLFF, A. in *Centralblatt für Bakteriologie, Parasitenkunde und Infektionskrankheiten*, Vol. 39, No. 15-17, pp. 411-419. Jena, November 29, 1913.

The writer has made a comparative bacteriological investigation of the pasture grass and the milk of cows grazing upon the latter, and has been able to establish a fairly close connection between the flora of the milk and that of the grazing ground. In addition to those bacteria (*Coli-aerogenes* group) which occur regularly in the milk and on the pasture alike, there are other specific pasture bacteria only to be found in the milk during the grazing season. As such may be mentioned *Bacterium trifolii, fulvum, herbicola Burri, lactorubefaciens*, and the short rod-like form inhabiting the common daisy. The similarity between the flora of the pasture and that of the milk depends largely upon the handling of the milk and of the udder ; it is usually greatest when such treatment is least good.

There is much less similarity between the flora of the milk and fodder of stall-fed cows than exists between the bacteria present in the pasture and the milk of grazing animals. This is chiefly to be attributed to the fact that the fodder comes less in contact with the udder in the stall than does the grass in the pasture. A closer relationship exists, in the case of stall-fed cows, between the milk and litter floras than between those of the milk and the fodder.

67 – **The Composition of Ewes' Milk Sold in Hungary (1).** — Biró, Gusztáv in *Kiserletügyi Közlemények*, Year XVI, No. 5, pp. 656-662. Budapest, Sept.-Oct. 1913.

Considering that in the great plain of Hungary, besides cows' milk, ewes' milk is also a staple article of trade, the Municipal Laboratory of agricultural chemistry of Kecskemet has undertaken the systematic analysis of the ewes' milk sold, in order to become acquainted with the approximate composition of whole ewes' milk. The greatest number of samples for analysis were taken without any selection at the local market from the mixed milk of the producers and of the retailers, whilst a very small quantity was taken when the control of milk was carried out. The most part of these control samples were compared with those taken in the sheep-folds, the latter generally containing a little more fat than the control samples. This difference was however very small (0.4 to 0.8 per cent.) and it may be attributed partly to the ordinary variations in the composition of milk and partly to the handling.

The following table shows the average composition of the whole ewes' milk sold on the Kecskemet market between April and August, and the extreme values of a series of analyses :

	S. G. of milk — 15° C.	S. G. of solids	S. G. of whey — 15° C.	Total solids	Fat	Total solids not fat	Ash	Fat content of total solids
Average.	1.0361	1.2210	1.0330	19.70	7.87	11.85	0.75	39.79
Minimum	1.0326	1.1597	1.0302	17.09	5.65	9.48	0.68	27.07
Maximum.	1.0406	1.2649	1.0355	22 98	10.45	13.82	0.88	54.30

68 – **Complete Churning and Questions Connected with it.** — Rosengren, L. F. in *K. Landtbruksakademiens Handlingar och Tidskrift*, Year 1913, No. 4, pp. 254-275. Stockholm, 1913.

The writer shows that the completeness with which the fat contained in milk passes into the butter cannot be ascertained with certainty by the fat content of the buttermilk, nor by the quantity of fat contained in the dry matter of the buttermilk, because both vary considerably according to the fat content of the cream and to the quantity of cream that has been taken from the milk. Thus the absolute quantity of fat remaining in the buttermilk derived from 100 lbs. of milk is the only evidence of the degree of churning which can be trusted. In Sweden it is considered that 1 oz. of fat in 125 lbs. of milk is the highest figure which should be found after satisfactory churning.

(1) See No. 585, *B.* May 1913. (*Ed.*).

The writer mentions several ways of calculating the percentage of cream obtained by skimming and the quantity of fat that remains in the buttermilk, and gives tables of the quantities obtained under different conditions.

Among the factors which influence the amount of butter made (Ausbutterungsgrad), the temperature at which churning is done is the most important. Too high a temperature is usually the cause of cream being less completely transformed into butter; it is especially so since the adoption of the combined churn and butter-worker, which allows churning at a relatively high temperature without any inconvenience to the quality of the butter and the manner of treating it.

It has been proved by experiments that churning at a temperature of 15° C. (59° F.) yielded 0.78 parts of fat in the butter-milk from 100 parts of milk, against 0.40 parts found after churning at 11° C. (51.8° F.), that is 4 ½ lbs. of butter in 100 gallons of milk.

Nevertheless, 11° C. (51.8 °F.) is not always the most favourable temperature for complete churning. Only a careful control of churning in every particular case will reveal the most suitable temperature. In general this temperature must be lower, the less the cream has been cooled before ripening, the higher the temperature of ripening, and the more the fat, owing to its chemical composition, lacks cohesion.

Even in those cases in which cream ripens at a temperature as low as 10 to 13° C. (50 to 55.4° F.) the temperature rises to such a degree during the process of ripening, especially in hot weather, that it is necessary in view of complete churning to cool the cream before straining it into the churn.

If the temperature of the cream has to be lowered by only 2 to 4° C. (3.6 to 7.2° F.), direct cooling by means of ice is the most suitable. About 20 lbs. of ice are required to cool 500 lbs. of cream at 57° down to 52° F. Of course the ice used for this purpose must be made with pure water, free from germs, preferably pasteurized water; this must also be without chemical impurities, especially salts of iron. In cases in which no ice machine is availabe, the best and cheapest way to make artificial ice is by placing a pan filled with water in a mixture of 100 parts of natural ice, 10 parts of coarse salt and 30 parts of water. The writer describes a simple apparatus for making ice in this way, by means of which he has obtained 66 lbs. of artificial ice by using 100 lbs. of natural ice.

Experiments have shown that the quantity of fat remaining in the buttermilk during churning was the same whether the cooling was performed by an ice bath or by ice being placed in the cream.

In order to obtain complete churning, some dairies, instead of cooling the cream, skim the buttermilk; by this method the amount of fat remaining in the buttermilk has been diminished from 0.79 to 0.46 per cent. The skimming has to be carried out at a low temperature, in order to avoid the coagulation of the buttermilk, which would reduce the separation of the fat to one-half or one-third of what couold be obtained by the usual machine separating. Besides, the salts of iron give the butter a bitter taste. Mixing

the cream skimmed off from the buttermilk with normal cream, as is commonly done, results in imparting a metallic taste to all the butter.

The fat content of the cream is also important for the completeness of the churning. Very poor and very rich creams are less completely churned than average ones.

It is supposed that if pasteurized cream allows of less complete churning than another cream, it is due to the amount of work to which it has been submitted, especially in the pasteurisers, which cause the cream to rise and whose stirrers revolve at a very high speed. This observation has been confirmed by experiment, for the greater the quantity of cream that could be treated by the pasteurizer in a given time, the more complete was the churning; on the other hand the speed of the stirrers had no effect whatever.

The extent to which the churn is filled also exerts an influence, at least in the rotary churns (barrel churns). The churning was less complete when the churn was less full, especially when the cream had a high fat content.

The writer lastly points out that among the large mechanical churns, the Danish churn and the modern combined churn and butter-worker also give a good complete churning; nevertheless, the former requires more scrupulous care in the handling than the latter. On the other hand the combined churn and butter-worker, when it is not quite full and when the cream is very rich, may give a less complete churning owing to the fact that it is more difficult to churn completely the cream which adheres to the projecting blades, to the axle, etc. This difficulty is overcome if towards the end of the operation the churn is given a few turns in the contrary direction; the washing is then more complete and the churning becomes satisfactory.

69 – **Promoting the Formation of Eyes in Emmental Cheeses.** – STEINEGGER in *Schweizerische Milchzeitung*, Year 39, No. 88, p. 1. Schaffhausen, November 4, 1913.

The writer recommends, on the basis of practical experiments, the addition of casolin to the rennet as a means of obtaining Emmental cheeses well and uniformly provided with eyes and able to stand storage. Casolin is found in trade; it is a mixture of acids which has no injurious effect on the taste and fineness of the cheese, or on the process of making it. Cheeses made with casolin begin to ferment in the warm cellar eight or ten days sooner than the others, and consequently the formation of the eyes begins sooner; it proceeds steadily and normally; after-fermentations in the cellar do not set in.

The rennet is prepared as follows: the stomach is placed in a suitable vessel and 300 c.c. of whey at 30° C. (86° F.) are poured over it; 2 to 4 c. c. (according to the eye formation desired) of casolin are then added and the mixture is stirred and kept for three hours at 30° C., shaking it every now and then. Then the usual amount of whey at 30° C. is added and the rennet is kept at the temperature required by circumstances. The rennet thus prepared is of perfect composition; it does not present floating pieces of stomach, nor has it any bad smell or taste. It possesses mostly an acidity

of 30 degrees, and when the casolin has been aded in a proper quantity, it never causes swelling or ropiness of the cheese. Casolin keeps good for a long time.

SUGAR INDUSTRY.

70 – **The Use of Hydrosulphites in the Manufacture of Beet Sugar.** — MARCUS, P. in *Journal des Fabricants de Sucre*, Year 54, No. 47, p. 1. Paris, November 19, 1913.

This paper is not a complete study of the whole question. The writer limits himself to the demonstration of the advantages realized at the sugar factory of Port-Salut-Verberie by the use of hydrosulphites at the commencement of the work of purification.

This operation costs about 1*d* per ton of beets, and allows of a saving of 30 per cent. on the limestone and 32 per cent. on the coke ; there follows a corresponding decrease in the scums, in the loss of sugar in the cake, of the water required for washing it and in the expense of the filtering mass in the press filters. Calculated per ton of beets, these savings work out as follows :

	d.
Stone and coke	3 ¾
Sugar in the scums	1 ¼
Water (economy of fuel).	1
Filters	½
	6 ½ *d*

Account should also be taken of the more rapid evaporation and of the almost complete suppression of incrustations, which involves an economy of fuel. But it is only in a well-conducted factory that hydrosulphites can be of use.

PLANT DISEASES

GENERAL INFORMATION.

LEGISLATIVE AND ADMINISTRATIVES MEASURES.

71 - **Modification of the Laws on Phylloxera Control in Italy.** — Legge del 26 giugno 1913, n. 786, che approva modificazioni al testo unico delle leggi 6 giugno 1901, n. 355, e 7 luglio 1907, n. 490, approvato con R. decreto 17 maggio 1908, n. 343, sui Consorzi di difesa della vitticultura; ed al testo unico, emanato con R. decreto 4 marzo 1888, n. 2552 (Serie 3ª), delle leggi intese ad impedire la diffusione della fillossera. — *Bollettino del Ministero di Agricoltura, Industria e Commercio*, Year XII, Vol. II, Series A, Part 11-12, pp. 338-340. Rome, September 13-20, 1913.

Art. 1. — The Antiphylloxera Societies, constituted in accordance with Arts. 2, 3 and 4 of the laws of June 6, 1901 (No. 355), and July 7, 1907 (No. 490), may benefit by loans repayable in 25 years for the purpose of enabling them to establish nurseries for the production of American stocks with which to reconstitute vineyards attacked and destroyed by phylloxera.

The Ministry of Agriculture, Industry and Commerce, shall fix, according to the report of the Consultative Commission on Plant Diseases (1), the amounts to be granted to each Society or Federation of Societies.

The necessary funds for the loans will be furnished by the Treasury of Deposits and Loans ("Cassa Depositi e Prestiti") at an interest not exceeding 4 per cent., and they shall not exceed 3 million francs a year, or a sum total of 16 millions.

The budget will include a special clause dealing with the grants of the Treasury of Deposits and Loans placed at the disposal of the Ministry of Agriculture for the purpose of loans to the Societies. The budget of the Ministry of Agriculture shall also include a corresponding clause concerning the payment of the loans to Societies after due approval of their work.

Any balance remaining at the end of a year shall be carried forward to the following year's account.

Art. 2. — The interest on the loans shall be paid to the Treasury of Deposits and Loans in July of each year by the Ministry of Agriculture, who will enter it in a special clause of the budget.

(1) See No. 413, *B.* Feb. 1912 (*Ed.*)

Seventy-five per cent of the annuities is charged to the Ministry of Agriculture and the remainder to the borrowing Societies, whose contributions will be guaranteed by assignments made over to collectors. To be entitled to the loan, the Society must undertake to pay according to Art. 12 of the law of May 17, 1908 (No. 343), for 25 years the contribution which shall be at least equivalent to the amount of the annuity due to the Treasury.

Art. 3. — Societies of any particular province or district may combine to form a Federation. These Federations may in the interests of Societies requesting it, negotiate loans according to the conditions of the preceding articles. Each Society will make its own payments by means of assignments according to Art. 3.

Art. 4. — For three years after the law has come into force, the Federations and Societies may obtain from the Ministry of Agriculture reimbursement to the extent of two-thirds of the cost of the American vines distributed to their members for the reconstitution of vineyards destroyed by phylloxera.

Art. 5. — The Federations of Antiphylloxera Societies of each Region may nominate, subject to the approval of the Ministry of Agriculture, a technical agent for the direction of protective measures for the vineyards of the Region.

The Federation shall be directed by a Regional Committee composed of three members: one appointed by the Provincial Deputations, a second by the Antiphylloxera Societies, and the third to be the technical agent. The Minister of Agiculture may, when he considers fit, appoint a special delegate to represent him on the Committee, who has the right to vote.

The Provincial Commissions shall consist of three members: one nominated by the Ministry of Agriculture, a second by the Provincial Deputation, and the third by the Antiphylloxera Societies. The administration of each Society shall be in the hands of a Commission of five members.

Art. 6. — To provide for the expenses anticipated according to Art. 2, a special clause will be included in the budget of the Ministry of Agriculture for 1913-14, granting the sum of 192 000 francs for each financial year until a sum total of 1 536 000 francs is reached.

To meet expenditure anticipated under Art. 4, a grant of 450 000 francs under clause 50 of the financial year 1912-1913 in the budget of the Ministry of Agriculture will be made, beginning with the financial year 1913-1914.

Art. 7. — No indemnity will be paid to proprietors for vines destroyed in infected and protected zones; the latter may not be more than 10 metres (33 ft.) in width.

At the same time the Ministry of Agriculture may grant special subsidies, in accordance with rules to be fixed by an enactment, for the destruction of vines in vineyards belonging to small proprietors or cultivated directly by small tenants.

Art. 8. — In the case of outbreaks over limited areas or threatening large areas of unattacked vines, the Ministry of Agriculture may on the suggestion of the Provincial Deputation appoint a Local Commission consisting of five members representing respectively the Ministry of Agriculture,

the Ministry of Finance, the Provincial Deputations, the Antiphylloxera Society and the vine-growers in the infected district. This Commission is responsible for arranging and carrying out the preventive measures.

The Ministry of Agriculture may delegate to it power to destroy infected and protected zones.

In the provinces possessing Antiphylloxera Societies, the Provincial Commission assumes the above-mentioned powers. The President of the Society in the infected region and the Provincial Councillor will take part in the proceedings of the Commission.

The expenses incurred in the destruction of vines under these circumstances shall be provided for by the Ministry of Agriculture, to be reimbursed in the proportions of 40 per cent. by the province, 10 per cent. by the Society, and 50 per cent. by the State.

The repayment of the sums due to the Treasury by the province and the Society will be effected by assignments to their respective collectors.

Art. 9. — This deals with the powers of the government to regulate various conditions concerning the laws affected.

DISEASES NOT DUE TO PARASITES AND OF UNKNOWN ORIGIN.

72 — **Partial Damages of Frost on Winter Cereals resembling Damage by Wild Animals.** — ZIMMERMANN in *Zeitschrift für Pflanzenkrankheiten*, Vol. XXIII, Part 6, pp. 332-334, plates IV-VI. Stuttgart, 1913.

The German Stations of Phytopathology frequently receive in winter specimens of winter grain (chiefly rye) supposed to be damaged by wild animals, in particular rabbits. Such plants are generally found to be in the last stage of a leaf disease induced by frost.

The action appears to be as follows : in periods of frost without much snow, parts of the blade (generally the tip) become discoloured by destruction of the chlorophyll, and eventually die. If the weather is damp, fungi such as *Septoria* and *Cladosporium* develop on these parts and may invade the healthy tissue to some extent ; but in dry weather the diseased parts shrivel up and drop off, thus producing an effect similar to nibbling by rodents.

The crops which recover best from this frost damage are those that have developed well owing to early sowing or to the frost coming late. Crops on light soil seem to be more susceptible, while rye after rye or oats seems not to recover so well as after other crops.

BACTERIAL AND FUNGOID DISEASES.

FUNGI.

73 – **The Occurrence of Rust Spores in the Intérior of Wheat and Barley Grains.** – BEAUVERIE, J. in *Comptes Rendus hebdomadaires des séances de l'Académie des Sciences*, 1913, 2nd Half-year, Vol. 157, No. 18 (Nov.3, 1913), pp. 787-790. Paris, 1913.

Continuing the observations made in 1912 (1) in the district of Beynost (Ain), the writer found large numbers of cereal grains containing the mycelium or uredo and teleuto-sori of rust. To detect their presence in wheat grains it is necessary to cut sections, since the fungus is localised more or less deeply in the pericarp and parenchyma of the groove. The writer has been able to show that the mycelia and spores belong to *Puccinia graminis*.

All the six-rowed barleys examined showed the presence of uredospores of *P. glumarum* in rows between the veins of the pale ; the sori actually develop on the inside of the pales, but owing to the fusion of these with the pericarp they come to lie within the grain and are turned towards the interior. In the case of two-rowed barley *P. glumarum* was found on the stems, while the ears remained free. The writer has observed a similar attack on *Bromus mollis* and *Agropyrum*, but the sori were not as readily visible to the naked eye as in the case of barley.

In all cases where the caryopses were attacked by the mycelium, it was observed that this did not spread into the albumen or the embryo ; it appears to be stopped in its progress by the tough membranes surrounding the aleurone layer of bare caryopses and by the adjacent epidermal layers of the pale and pericarp in covered grains. It is only when this protective layer is broken (as in threshing) that the mycelium can penetrate.

The writer is thus led to infer that on all fruits of Gramineae attacked by *Puccinia* the sori are turned towards the interior. The dehiscence of these sori can only take place as a result of the destruction and decomposition of the layers of cells covering them ; this only takes place by bacterial or other decomposition after the seed has germinated.

Finally it appears that the occurrence of rust spores within the caryopsis may be of considerable practical importance from the point of view of the spread of the disease.

74 – **Contribution to the Biology of Naked Smut of Barley *(Ustilago nuda)*.** — BROILI, J. and SCHIKORRA, W. in *Berichte der deutschen botanischen Gesellschaft*, Vol. XXXI, Part 7, pp. 336-339, 1 fig. Berlin, 1913.

This is a preliminary communication of the results of researches into the biology of naked smut of barley begun by Broili at Jena and continued by him at Bromberg in collaboration with Schikorra.

Sections of caryopses, when treated with chloral hydrate, immediately show the presence or otherwise of the fungus. Out of 409 caryopses from ears artificially infected, 162 showed the presence of mycelium.

(1) See No. 879, *B.* July 1913. (*Ed.*).

Broili had already observed that on ears artificially infected the glumes very often became partially separated. In 1913 this was used as a basis of selecting grains suspected of infection: of 21 selected grains, 13 produced smutted plants. With commercial seed it has been possible by using this character to reduce the percentage of infected plants from 2.3 to 1.6, as shown by field trials in 1913.

The distribution of mycelium in the seeds and seedlings was worked out by staining microtome sections with gentian violet and methyl orange. These researches have shown that the mycelium in resting and germinating seeds is especially abundant in the region of the scutellum, but is also present in various parts of the embryo.

To induce growth of the dormant mycelium in the grains, portions of tissue as nearly sterile as possible were sown onto potato media and nutrient agar and gelatine. Pure cultures were obtained from all. The cultures from different grains all produced the same characteristic growth of the fungus. Inoculation experiments were undertaken to confirm its identity with the original smut: potato cultures were used for inoculating various parts of the growing stems, and the pistil during flowering. The identity of the fungus was also confirmed by observations on the nuclear condition of the cells, which were found to correspond with that given by Rawistcher for *Ustilago Maydis*.

On the duration of vitality of the fungus no new information has been obtained. The attack of the disease on the crop of Bethge II barley sown at Bromberg in 1913 from the seed of the 1908 harvest appeared in the same percentage (2.3) as the crop of the same seed sown in 1909.

The method of inducing growth of the quiescent mycelium in the caryopses will be useful in testing the action of means of destroying smut; it is thus easy to determine if the mycelium has been damaged or killed.

MEANS OF PREVENTION AND CONTROL.

75 – ***Cicinnobolus* sp. Parasitic on Apple Mildew *(Oidium farinosum)*.** — OBERSTEIN, O. in *Zeitschrift für Pflanzenkrankheiten*, Vol. XXIII, Part 7, pp. 394-396. Stuttgart, November 18, 1913.

After enumerating the species of *Cicinnobolus* described in previous years as parasitic on other injurious fungi — *Cicinnobolus* sp. on *Sphaerotheca mors-uvae* (1), *C. Cesatii* f. *Euonymi* on oak mildew (2), *C. Kusanoi* on *Oidium* sp., *C. Abelmoschi* on *O. Abelmoschi* (3) — the writer records as new the occurrence in Prussia of *Cicinnobolus* sp. on *O. farinosum*. This case was observed on apple twigs attacks by *Oidium* (4) in the districts of Bernsdorf and Trebnitz.

(1) See No. 300, *B.* Jan. 1911.

(2) See No. 998, *B.* March 1911.

(3) See No. 240, *B.* Jan. 1912. In addition to the above species, *C. bremiphagus*, on *Bremia graminicola*: cf. No. 878, *B.* July 1913.

(4) See No. 1356, *B.* Sept. 1912. (*Ed.*).

BACTERIAL AND FUNGOID DISEASES OF VARIOUS CROPS.

76 — **Diseases and Pests of Plants in Belgium in 1911 and 1912.** — POSKIN, J. (Entomological Service) and MARCHAL, E. (Phytopathological Service). — *Ministère de l'Agriculture et des Travaux publics, Office rural, Rapports et Communications*, No. 7, pp. 59-85, figs. 1-2. Brussels, 1913.

The meteorological conditions during 1911 were quite different from those of 1912, the former year being hot and dry and the latter cool and wet.

Fungi. — In 1911 *Urocystis occulta* was very abundant on rye; *Puccinia glumarum* was more abundant on wheat than usual, while *P. graminis* was only occasional on oats. In 1912 the percentage of six-rowed barley attacked by *Ustilago Hordei* was high, whilst *U. Jensenii* on barley and *Puccinia graminis* on oats were less abundant.

Potato blight did not appear in 1911, but scab was prevalent, and the same may be said of heart-rot of beets. Owing to the heavy rainfall in 1912 potatoes were in some cases blighted to the extent of 40 per cent. of the crop; *Macrosporium Solani* was noticed in great abundance for the first time, without doing serious damage. The nearness of centres of infection of wart disease (*Synchytrium endobioticum*), which has not yet been found in Belgium, induced the authorities to make known among farmers the characters of this serious disease.

Endives suffered considerable loss in 1912 from *Aecidium Lactucae-sativae.*

In 1911 *Exobasidium Azaleae* was common on azaleas, and in 1912 a fungus identified as *Pyrenochaeta Bergevini* on *Aspidistra.*

Sphaerotheca mors-uvae did not appear in 1911, but in the following year it almost everywhere completely destroyed the goosebery crop. In 1911 *Aecidium Grossulariae* was also common on *Ribes* and *Gymnosporangium Sabinae* on pears; *Septoria piricola* was rare. The "Rhine disease" of cherries, not yet well known, also appeared in rare instances. The excessive heat produced frequent scorching of vine leaves, especially in low badly-ventilated houses.

Lophodermium brachysporum was recorded on *Pinus Strobus* for the first time in 1912; it does not do much damage.

Insects. — Roses were attacked by aphids, *Typhlocyba rosae* and Tenthredinids. The attacks of *Hyalopterus pruni*, *Myzus ribis* and *M. cerasi* on fruit trees were perhaps worse than usual. *Aphis mali* was unusually bad, while *Schizoneura lanigera* continues to spread.

M. Poskin had already recorded that native oaks were seriously menaced by *Heterognomon viridana*, *Coccus quercicola* and mildew, especially on calcareous soils; in the neighbourhood of Valenciennes, the Buprestid *Agrilus biguttatus* has also been very harmful. The following insects have been observed on *Quercus palustris*: *Trypodendron domesticum*, *Xyleborus dispar*, *Ips quadripunctatus*, *I. quadriguttatus* and *Soronia grisea.*

Mammals. — Ranysz virus has been found efficacious against rodents, including rats, in various places.

77 – **Inquiry and Observations on Straw Blight of Wheat** (1) **in the Department of Aisne, France.** — GUERRAPAIN, A. and DEMOLON, A. in *Journal d'Agriculture pratique*, 1913, Vol. II, No. 44, pp. 566-567, 1 fig.; No. 46, pp. 627-630. Paris, October 30 and November 3, 1913.

The writers have made a very general inquiry by means of correspondents on the disease known as "piétin" or "pied noir" (straw blight), which has for some years been so rampant as to cause alarm among the farmers of the Department of Aisne. In 1913 this disease reduced the crop by 5 to 10 per cent., and in some cases even 60 per cent.

The following questions were discussed in the inquiry: influence of climatic conditions, distribution of the disease, effect of soil and cultural conditions(season, density of sowing, varieties of wheat grown, manures), plants attacked, effect of the preceding crop, efficacy of copper sulphate.

From a consideration of the information received from their correspondents the writers remark that, although no remedy has yet been found, the agriculturist is not quite defenceless. The following causes appear to favour the development of the disease: *a*) an abnormally mild winter; *b*) excessive growth early in the season owing to early sowing, excess of nitrogen and the particular variety grown, etc.; *c*) infection of the soil, chiefly where winter grain (especially wheat) is taken frequently: the manure and the stubble contain the source of infection.

On the other hand, the following factors tend to diminish the spread of the disease, either by protecting the plant against infection or by making it more resistant: *a*) early and hard winters; *b*) not sowing the crop too soon: land which has been previously attacked should not be sown first; *c*) avoiding excessive growth of the corn before winter: a dressing of superphosphate and nitrate of soda may be given in the early spring; *d*) thorough ploughing in of the manure and stubble in preparing for wheat; *e*) in badly infested land. lengthening the rotation, taking some such crop as lucerne.

There is little probability that any practical remedy can be found. According to the writers it is better to adopt preventive measures, which will be easier to carry out when more complete knowledge of the mode of infection has been obtained.

78 – ***Stilbum flavidum*, Parasitic on Coffee, and its Systematic Position.** — MAUBLANC, A. and RANGEL, E. in *Comptes rendus hebdomadaires des séances de l'Académie des Sciences*, 1913, 2nd Half year, Vol. 157, No. 19 (Nov. 10, 1913) pp.858-860. Paris, 1913.

Stilbum flavidum Cooke is well known throughout tropical and subtropical America as the cause of roundish dry spots on the leaves of coffee. The writers have recently studied this fungus in the neighbourhood of Rio de Janeiro on coffee and other plants (*Eriobotrya japonica* and various Melastomaceae, Compositae and Rubiaceae). There is little doubt that *S. flavidum* occurs naturally in the forests on various shrubs. This origin

(1) See also No. 731, *B.* April 1912 and No. 1103 *B.* Sept. 1913. (*Ed.*).

explains the local distribution of the fungus, which in Brazil occurs chiefly in the coastal regions, where it finds the heat and moisture necessary for its development.

All attempts at classification had been unsuccessful owing to the sterility of the fungus. In moist chambers the writers have at last obtained fructifications of a typical Agaric, the characters of which refer it to the genus *Omphalia*; it apparently constitutes a new species (*O. flavida*). The resemblance in colour and the position of the basidiomycetes on the edge of the spots, as well as the occurrence in some of the spots of all intermediate stages between *Stilbum* and *Omphalia*, lead the writers to consider that the former is merely an abortive and sterile stage of the latter. The absence of reproductive organs in the sterile form is compensated by the vegetative growth of the cells of the atrophied pileus, which becomes loose and may attach itself to other plants. This is their ordinary method of reproduction; the *Omphalia* forms always require very damp conditions, such as must be rare even in forests during the rainy season. The persistence of great humidity is not the only condition requisite for the development of the *Omphalia* fruits: it seems that they only develop on the edges of fresh spots, that is to say in the parts in which the mycelium is young and well nourished.

79 — ***Fusarium bulbigenum* on Narcissus Bulbs.** — MASSEE, G. in *Royal Botanic Gardens, Kew, Bulletin of Miscellaneous Information*, No. 8, pp. 307-309, 1 plate. London, 1913.

This disease was first observed on Narcissus bulbs three years ago, but did not cause serious damage until this year. The fungus which destroys the interior of the bulbs was first described in 1887 as *Fusarium bulbigenum* Cooke and Massee, but it was not considered a parasite.

The first symptoms of the disease are yellowish spots which grow in size, become brown and develop pale salmon-coloured specks, at first gelatinoue and becoming brown and dry on exposure to the air. These specks are the spore masses of *Fusarium*, which spread the disease to neighbouring plants. The mycelium of the leaves grows downwards into the bulbs, where it develops rapidly in the fleshy scales. The first symptoms of attack in the bulbs are found round the neck, but the whole bulb soon becomes uniformly brown in colour. A delicate white mycelium is formed on the scales, in which are embedded the chlamydospores. The characteristic conidia of *Fusarium* also appear. The complete destruction of the bulb is soon completed by saprophytic fungi (*Penicillium*) and insects (*Rhabdites*).

The chlamydospores set free by the decay of the bulb germinate in the soil and produce secondary spores which infect the leaves of narcissi in the following spring.

Young leaves inoculated with the spores showed signs of the disease in six days, and the symptoms spread with the growth of the leaves. Mycelium was found in considerable quantity in the tissues one week after infection. It sems very probable that infection of the young leaves takes place by means of the secondary spores produced by the chlamydospores and that the successive infection of the lower parts of the plant and the bulb takes place

from spores washed down from the diseased patches of the leaves. Chlamydospores are also found abundantly in the leaf tissues. The spread of the disease may be effected in two different ways : either by spores of the fungus contained in bulbs only slightly diseased, or from infected soil.

The disease is well known in Holland, and it has probably been re-introduced into England in imported Dutch bulbs slightly infected.

80 – **The Rotting of Bunches of Grapes produced by *Phoma* sp., in Algeria.** — TRABUT, L. in *Bulletin agricole de l'Algérie et de la Tunisie*, Year 19, No. 17, pp. 341-342. Algiers, September 10, 1913.

In 1913 a serious disease broke out in a vineyard at Ténès (Algiers), causing the entire withering of the bunches ; the disease first appeared on the colouring fruit and continued to develop after the fruit was ripe, causing a large portion to wither up. The petioles were also attacked in some cases, showing first a whitish tinge, then darkening ; the leaves then dried up and fell off. The shoots and fruits were sprayed with copper sulphate several times, but without result.

On examining the tissues at the origin of the peduncle, the writer found a fungus with large spores easily recognised as a species of *Phoma*, resembling *Coniothyrium Diplodiella*, which causes white rot. Thus the writer attributes the damage to a specialised form of white rot. The fungus evidently causes a withering of the bunches by checking the flow of the sap. No trace of the parasite has been found on the leaves, but it is very probable that it attacks the petioles. This particular form of white rot is remarkable in that it does not attack the fruits, which simply wither.

More detailed study is required to determine the exact importance of this disease, its causes, and suitable means of preventing it.

PARASITIC AND OTHER INJURIOUS FLOWERING PLANTS.

81 – **On the Germinating Power of Seeds of *Orobanche crenata* after passing through the Digestive Tracts of Cattle and after Fermentation in the Dung.** — MORETTINI, A. in *Le Stazioni sperimentali agrarie italiane*, Vol. XLVI, Part 9, pp. 599-606. Modena, 1913.

PARASITIC AND OTHER INJURIOUS FLOWERING PLANTS.

The writer has conducted experiments at the Royal Institute of Experimental Agriculture at Perugia, on the seeds of *Orobanche crenata*, which does a great deal of damage to beans in the centre and south of Italy (1). The object of these researches was to determine : *a*) if the seeds can resist the chewing and digestive processes when eaten by cattle ; *b*) if the germinating power of the seeds is affected in the subsequent action of the dung and litter.

From the results of experiments carried out from 1911 to 1913, the writer concludes that the germinating power of the seeds is not affected in

(1) See No. 867, *B.* May 1912 and No. 1362, *B.* Sept. 1912. (*Ed.*).

passing through the digestive tract of cattle when eaten with ordinary forage, the majority of the seeds being expelled within 12 to 48 hours after ingestion. On the other hand they lose their power of germination when subjected to the fermentative changes of the dung. They are also affected similarly when immersed in the liquid manure.

The destructive action of the dung is equally efficacious if the seeds are mixed with it when it is already partially decomposed. In actual practice, therefore, decomposed dung is not an agent for dispersing the seeds as is the case with fresh dung. Thus there is no danger from throwing the fruit capsules of *Orobanche* into dung heaps that are well conserved, though their destruction by more certain means is always preferable.

The writer concludes that, considering the anatomical and physiological affinities among the better known species of *Orobanche*, similar means may be adopted for destroying the seeds of the other species parasitic on crops.

82 – ***Fagopyrum tataricum* as a Weed among Buckwheat in Vohynia (Russia).** — KAMESKY, K. in *Wissenschaftliches Comite des landwirtschaftlichen Ministeriums, Bulletin für angewandte Botanik*, Year 6, No. 7, pp. 496-497. St. Petersburg, 1913.

In the summer of 1912 the writer observed *Fagopyrum tataricum* (1) as a fairly abundant weed in fields of buckwheat in Volhynia, though the species had not been definitely recorded before from the district. It seems very probable that it has been imported into this district, as into other parts of Russia-in-Europe (Chernigov, Kursk, Yekaterinoslav, Kherson, Don), though it is indigenous to Siberia.

INSECT PESTS.

GENERALITIES.

83 – **First Annual Meeting of the "Deutsche Gesellschaft für angewandte Entomologie".** (2) — *Communicated to the International Institute of Agriculture.*

The German Society of Applied Entomology ("Deutsche Gesellschaft für angewandte Entomologie") held its first annual meeting from the 21st to the 25th of October, 1913, at Würzburg, Bavaria.

By invitation of the German Pomological Society, Eisenach (Saxe-Weimar), was chosen as the place for the next annual meeting of the Society. The presidency of Doctors Escherich, Schwangart and Heymons, hitherto provisional, was confirmed at the meeting, and in addition Doctor Winter of Frankfort was appointed secretary. A special commission was appointed for studying questions relating to the organization of Applied Entomology in the different branches of agriculture, colonial entomology and medicine, as well as the breeding of beneficial insects.

A considerable sum was contributed towards funds for the maintenance of travelling research studentships.

(1) See also No. 1401, *B.* May 1911. (*Ed.*).
(2) See No. 890, *B.* July 1913. (*Ed.*).

84 – ***Bacillus Gortynae, B. Pyramsis I* and *B. Pyrameis II*, parasitic on the larvae of *Gortyna ochracea* and *Pyrameis cardui*.** (1) — PAILLOT, A. in *Comptes rendus hebdomadaires des séances de l'Académie des Sciences*, 1913, 2nd Half-Year, Vol. 157, No. 15, pp. 608-611. Paris, October 1913.

MEANS OF PREVENTION AND CONTROL.

The writer describes the morphological and cultural characteristics of three new bacilli, isolated from the tissues of the larvae of *Gortyna ochracea* and *Pyrameis cardui*. The former caused a small epidemic amongst the larvae in May 1913. There is little to distinguish the diseased larvae in the early stages, but in the later stages the movements gradually become weaker; after death the body decomposes forming a blackish mess. Inoculation of healthy larvae with serum containing the bacilli from diseased ones does not always produce infection, though it is always successful with the larvae of *Lymantria dispar*.

8 **climatization of *Novius cardinalis* in France.** – MARCHAL, PAUL in *Comptes rendus hebdomadaires des séances de l'Académie des Sciences*, 1913, 2nd Half-year, Vol. 157, No. 15 (Oct. 13, 1913), pp. 561-564. Paris, 1913.

The writer gives the results of the campaign of 1912 in the South of France (Alpes-Maritimes) under the Direction of the Scientific Service of the Ministry of Agriculture for the Control of *Icerya purchasi* (2) by means of *Novius cardinalis* (3).

A succession of supplies of this ladybird was obtained by the Paris Entomological Station from Italy, Portugal and the United States. Large numbers of these insects were bred in cages and some 1000 individuals in different stages of development were placed in boxes or metallic tubes with fairly large holes and hung on various plants (Aurantiaceae and ornamental shrubs) attacked by the scales towards the 15th of August.

By the end of September they had become acclimatized. At the end of 1912 they had spread over all the infected trees, and in the garden in which the first batch had been distributed the scale was entirely destroyed. The development of both insects was arrested during the winter. In the following spring the scale insect broke out again. Fresh colonies of the ladybirds were distributed and in July and August they had so reduced the scale insects as to be short of food. However, a sufficient number survived to check a fresh outbreak of the scale in the early part of October.

The writer considers that this scale is now completely under control in the South of France owing to the acclimatization of *Novius cardinalis*.

86 – **Injurious Insects and Other Animals observed in Ireland during the Year 1912.** – CARPENTER, GEORGE H. in *Economic Proceedings of the Royal Dublin Society*, Vol. II, No. 6, pp. 79-104, figs. 1-9, plates X-XI. Dublin, 1913.

INSECTS INJURIOUS TO VARIOUS CROPS.

The writer gives an account of insects observed as injurious to crops and forest trees in Ireland in 1912.

(1) See No. 1308, *B.* Nov. 1913. (*Ed.*).
(2) See No. 621, *B.* May 1913; No. 891, *B.* July 1913; Nos. 1010 and 1013, *B.* Aug. 1913.
(3) See No. 891, *B.* July 1913. (*Ed.*).

87 – **The Serpentine Leaf-miner (*Agromyza pusilla*) injurious to Alfalfa and Other Crops in the United States.** – WEBSTER, F. M. and PARES, T. H. in *The Journal of Agricultural Research*, Vol. I, No. 1, pp. 59-88, figs. 1-17, plate 5. Washington, October 1913.

Agromyza pusilla is a minute yellow and black fly and was described in 1830 as occurring in Central Europe, but without definite locality or host plant. The habits of the larvae of this insect, as leaf-miners of clover, have long been known both in Europe and America. With the rapid increase of alfalfa culture in the United States, especially in the irrigated sections of the West, the damage of this insect amongst forage crops has been more frequently brought to the attention of the Bureau of Entomology and it has been the subject of investigations by several members of the Section of Cereal and Forage Crop Insect Investigations during three years.

As a result of recent research, the following species are considered synonymous with *A. pusilla*: *A. pumila* Meig., *A. strigata* Meig., *A. exilis* Meig., *A. amoena* Meig., *A. puella* Meig., *A. pusio* Meig., *A. orbona* Meig., *A. blanda* Meig., *A. diminuta* Walker (?), *Oscinis trifolii* Burg., *Oscinis brassicae* Riley.

It is generally distributed throughout the United States, having a wide range of food-plants. It also occurs in Europe, but on fewer host-plants. In the larval state it is commonly found in alfalfa fields during the summer. The larvae injure the foliage of the plant by burrowing between the membranes of the leaf and devouring the parenchyma. The injury takes the form of a serpentine mine which encircles the leaf, gradually widening as the larva increases in size. Leaves of white clover and frequently of young alfalfa often have the entire cellular tissue devoured, leaving only the two membranes. Usually only one larva is present in each leaf.

The injury from this insect is greatest in the south-west, where the discoloured leaves, which in severe cases become brown, are sometimes present in sufficient numbers to lower the quality and grade of the hay. The injured leaves can be found in the fields from May until November, the larvae continuing to feed until killed by frost. In Florida the larvae continue feeding throughout the winter.

The insect hibernates in the puparia beneath the surface of the soil at the base of the plants. In latitude 40° there are five or six generations, and the number varies with the length of the growing season. Generations overlap to such an extent that all stages can be found in the fields during most of the summer.

During the hottest part of the summer the larvae are usually found in those plants protected from the direct rays of the sun, and in the arid south-west the insect almost completely disappears from the fields during this period, reappearing again in September.

The eggs are deposited in the leaf tissue and inserted in punctures identical with those made by the adult in feeding. The period of incubation during June is about four days. The larval period lasts the same length of time, during which the larvae confine themselves to one leaf each and feed day and night. In the Eastern States pupation occurs entirely in the soil, while in the arid Western States it usually takes place in the

larval chambers of the leaf, and is of ten days' duration in June. Thus the average period of the complete life cycle is 23 days.

Besides alfalfa, the following field crops are subject to attack : clover, cowpeas, rape and cotton.

Other species of *Agromyza* have similar habits and are easily confused, *viz. A. angulata* Loew, *A. coquilletti* Malloch, *A. virens* Loew and *A. melampyga* var. *marginalis* Malloch, well-known parasites of timothy, wheat, oats and grasses. In these attacks the mine usually extends the entire width of the leaf and may kill the plant if it is very young.

The larvae and pupae are liable to the attack of numerous parasitic insects, which are highly efficient in keeping the pest under control ; but these parasites are less numerous on the approach of cool weather. They are as follows: *Diaulinus begini* Ashm., *D. websteri* Cwfd., *Chrysocharis ainsliei* Cwfd., *C. parksi* Cwfd., *Derostenus arizonensis* Cwfd., *D. diastatae* How., *D. punctiventris* Cwfd., *D. pictipes* Cwfd., *D. varipes* Cwfd., *Daulinopsis callichroma* Cwfd., *Daulinopsis* sp., *Cirrospilus flavoviridis* Cwfd., *Cirrospilus* sp., *Zagrammosoma multiplicata* Ashm., *Closterocerus utahensis* Cwfd., *Pleurotropis rugosithorax* Cwfd., *Eucoila hunteri* Cwfd., *Sympiesis* sp. (?), *Pteromalus* sp., *Opius agromyzae* Vier., *O. aridus* Gahan, *O. brunneipes* Gahan, *O. suturalis* Gahan, *Triphleps* sp. and *Erythraeus* sp.

Many of them are very widely distributed and attack more than one species of leaf-miner.

Frequent cutting of alfalfa kills the larvae in the leaves and does much to protect this crop. This method should be followed where the injury becomes serious. Deep autumn or winter ploughing is advocated for annual forage crops and cereals, in order to bury deeply the hibernating puparia located near the surface of the ground.

88 – **The Metallic Flea Beetle *(Haltica pagana)*, a New Pest of Strawberries in Victoria (Australia).** — FRENCH C. (Jun.) in *The Journal of the Department of Agriculture of Victoria, Australia*, Vol. XI, Part 10, p. 591. Melbourne, October 1913.

Recently the strawberry crops in the districts of Wandin and Evelyn have been seriously damaged by swarms of insects which made numerous small holes on the leaves and young buds, causing them to wither. This insect has been identified by the writer as *Haltica pagana*, an indigenous beetle formerly feeding on two other Rosaceous plants, *viz. Acaena ovina* and *A. Sanguisorbae* or " sheep burrs ".

This is an additional example of an indigenous insect leaving its natural host and attacking an introduced plant. The writer issues a warning of the dangers of the insect to other rosaceous crops (apples, pears, plums, etc.).

Arsenate of lead is an effective remedy, but cannot be used when the plants are bearing fruit. Kerosene oil or benzole might be used to prevent an attack and the insects may be caught in quantities by shaking the plants over tarred boards.

INJURIOUS VERTEBRATES.

INJURIOUS VERTEBRATES.

89 — **The Control of Voles in the Val di Chiana, Italy.** — PASSERINI, N. and MARCHI, C. in *Atti della Reale Accademia economico-agraria dei Georgofili di Firenze*, Series 5, Vol. X, Part 4, pp. 363-367, 1 fig. Florence, 1913.

In the autumn of 1912, after the ploughing-up of some grassland for wheat, so many voles appeared as to endanger the crop. Experiments were made on voles in captivity by feeding them on maize poisoned with white arsenic, sodium arsenite or zinc phosphide (1) ; the latter substance was the most effective and was preferred in spite of its cost, a mixture containing 1 per cent. being sufficient to destroy the vermin within 4 or 5 hours.

To avoid poisoning fowls, the mixture was placed between two tiles bound crosswise by pieces of wire. This method gave very good results, as dead voles soon began to be found in the fields ; on digging into the burrows, many more were found, as many as 20 in a single burrow. The treatment was extended and the voles entirely exterminated. This method is very economical, since the traps are protected from rain ; in this case they were left in position from November to March.

A larger number of traps was placed in the badly infested region, and they were moved from place to place as the voles were destroyed. Each trap may serve for about 500 square yards, and the total cost does not exceed 1*s* 6*d* per acre.

The dead voles on the surface of the fields attracted large numbers of kestrels, which devoured them leaving only the head and digestive apparatus.

(1) See also No. 329, *B.* March 1913. (*Ed.*).

ALFREDO RUGGERI, *Gerente responsabile.*

FIRST PART.

ORIGINAL ARTICLES

Composition and Agricultural Value of the Arable Lands in the Argentine Republic.

Part II: Provinces of Cordoba, San Luis, Mendoza, San Juan and Santiago del Estero, and National Territory of the Central Pampa.

by

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Province of Cordoba. — Bordering on the west the southern part of the province of Santa Fé and the northern part of the province of Buenos Aires, there is a vast extent of plains belonging to the province of Cordoba, which is in reality the continuation of that which forms the two neighbouring provinces already described ; that is to say that in the province of Cordoba in the neighbourhood of the two above-mentioned provinces the same kinds of soil are found. They are in fact loams, sometimes rather heavy ; further off they become sandy and this latter character prevails in the whole of the south of this province.

The total area of the province of Cordoba is estimated at 42 000 000 acres, while the plain extends for about 24 700 000 acres ; the rest is taken up by the mountain masses of the north-west and some salt areas in the north.

In the part adjoining the provinces of Santa Fé and Buenos Aires, on an area including about 12 000 000 acres, it may be said that at present about one-quarter is under wheat and maize; oats are not much grown and only 346 000 acres are sown to flax. We give in Table IV the analyses of some of the good soils of this part of the province of Corboba.

The tenacity of the subsoil is inferior to that in the provinces of Santa Fé and Buenos Aires, and it diminishes still further in the part adjoining the latter province. The impermeable layer of " tosca " exists also in the whole of this plain, but in the eastern belt it occurs at a good depth (26 to

TABLE IV. — *Analyses of Soils. Province of Cordoba.*

	I		II		III		IV	
	S Light brown	S' Yellow-brown	S Yellow-brown	S' Yellow	S Yellow-brown	S' Yellow.	S Yellow-gray	S' Yellow-gray
Fine gravel . . . . %	0	0	0	0	0	0	0	0
Coarse sand . . . . . »	19.70	22.30	44.10	47.20	3.40	1.70	75.40	746.0
Fine sand	69.60	66.00	45.50	43.70	82.80	78.20	19.80	210.0
Total sand. . . . . »	89.30	88.30	89.60	90.90	86.20	79.90	95.20	95.60
Clay . . . . . »	6.90	10.20	7.50	6.50	11.50	17.20	3.30	3.60
Humus . . . . . »	1.00	0.20	0.90	0.40	0.90	0.50	0.20	0.20
Organic detritus and soluble matter. .	2.80	1.30	2.00	2.20	1.40	2.40	1.30	0.60
Nitrogen . . . . . ‰	1.46	0.62	1.37	0.76	1.53	0.95	0.63	0.69
Total lime (CaO) . . »	7.92	8.46	9.66	10.42	7.03	7.92	8.29	8.74
Soluble lime	3.14	2.80	3.81	3.53	3.08	3.53	2.69	3.14
Potash (K_2O) . . . »	5.74	4.32	5.98	5.51	6.82	8.64	3.80	4.10
Phosphoric acid . . »	1.39	0.97	1.27	1.18	1.78	1.52	1.03	1.03

Analyses: Nos. I, II: Eastern belt; No. III: South-Eastern belt; No. IV: Southern belt.
S = Soil ; S' = Subsoil.

50 feet) ; in the low-lying parts it comes nearer to the surface and even sometimes crops out, holding up the water of more or less important lagoons, all of them brackish.

In the higher soils, where the impermeable " tosca " bed is at some depth, the river water accumulating upon it forms an underground sheet of water, which keeps the overlying ground in a state of permanent humidity very favourable to the development of plants possessing deep roots and especially lucerne ; consequently this forage plants covers considerable extents of land (3 700 000 acres in the whole province).

The soil is of medium tenacity or light, and therefore very easy to till ; it would dry out easily if it were not for the humus which it contains in large quantities, and which both increases the cohesion and helps to hold a certain amount of moisture. With a nitrogen content sometimes above 2.50 per 1000, these soils are very rich in potash and have also a high phosphoric acid content; the lime content is low, exceeding 10 per 1000 only towards the mountains. These are very fertile soils, suitable for all crops.

In the rest of this plain, which is about 13 000 000 acres in extent and extends throughout the south of the province of Cordoba, the soil is generally sandy ; soils with 10 per cent. of clay are rare, 7 per cent. being an average, and in many cases it is as low as 3 per cent. The moisture in the subsoil, due to the presence of the water table at a slight depth, already mentioned

above as existing in the east of this province, continues to appear on a vast area on both sides of the Pacific railroad which crosses the southern part of the province approximately from east to west. On travelling by this line, one is surprised to see the enormous extent, often as far as the eye can reach, occupied by lucerne and interrupted by wheat and maize, the two latter together occupying an area of about 3 500 000 acres.

From the above it will be seen that this is a region whose future lies in mixed farming: breeding and dairying with cultivation of wheat and flax, the latter prevailing on the heavier land towards the east, while on the west and especially to the south stock breeding will prevail on account of the lightness of the soil. In the whole of this plain fruit-growing gives excellent results.

A good deal might be said on the soils of the mountain region of this province, an important part of which is still covered by forests ; these are exploited in some localities, near means of communication, for charcoal and for fence-posts ; there are also considerable areas under cultivation. Some of these lands are irrigated, but a great deal more might be done by suitable works which would allow the numerous watercourses descending from the mountains to be utilized. In general the soils are fairly calcareous. Fruit does remarkally well, both for quantity and quality; vines also thrive in these soils, which are indeed suitable for a number of crops, especially lucerne.

National Territory of the Central Pampa. — To the west of the province of Buenos Aires and to the south of that of Corboba lies the territory of the Central Pampa, which is a continuation of the plains described above, with soils similar to those of the neighbouring provinces ; in general they are light and sandy, somewhat heavier in the part near the province of Buenos Aires ; in the southern part, however, they are very sandy and often shifting.

This vast territory, extending over 36 million acres, bears cereals on about 2 ½ million, chiefly on the land in the east and north-east which presents more cohesion, but the full extent of the acreage which might be brought under cultivation is still difficult to estimate. The rest of this territory is almost all uncultivated ; it is studded with numerous clumps of Algaroba trees (*Prosopis Algarobilla*) occupying areas of varying extent. Towards the west there are many salt soils ; indeed this western half of the plain is within the arid belt of 200 mm. (8 inches) of yearly rainfall, in which agriculture would not be possible without the aid of irrigation ; as fresh water, both superficial and subterranean, is completely lacking, it is a region in which agriculture has a very limited future, and which is hardly suitable even for sheep breeding.

The other half of the Pampa gets from 200 to 400 mm. (8 to 16 inches) of rainfall and only the north-eastern corner, that is, one of the parts that we have mentioned as the most fertile, is within the belt of 600 to 800 mm. (24 to 32 inches) which embraces all the south-west of the province of Buenos Aires and almost the whole of that of Cordoba. In this north-eastern section, and perhaps also in other localities situated in the eastern

TABLE V. — *Analyses of Soils. Pampa Territory.*

	I	II		III		IV		V	VI	
	S Light brown	S Brown	S' Light brown	S Yellowish brown	S' Yellowish brown	S Brown	S' Brown	S Gray	S Yellowish brown	S' Yellowish brown
Fine gravel . . . . . %	0	0	0	0	0	0	0	0	0	0
Coarse sand . . . . . »	62.20	24.10	30.70	33.40	32.80	57.10	59.40	76.10	81.00	79.50
Fine sand . . . . . »	27.20	66.00	59.80	54.33	56.22	37.23	35.59	17.80	16.19	16.94
Total sand . . . »	89.40	90.10	90.50	87.73	89.02	94.33	94.99	93.90	97.19	96.44
Clay. . . . . »	7.70	8.00	8.30	10.30	8.60	4.00	3.90	2.94	2.20	2.80
Humus . . . . . »	0.70	1.30	0.60	0.60	0.60	0.50	0.30	1.00	0.10	0.10
Organic detritus and soluble matter . . »	2.20	0.60	0.60	1.37	1.78	1.17	0.81	2.76	0.51	0.66
Nitrogen . . . . . ‰	1.91	1.50	0.70	1.09	0.91	1.23	0.52	0.52	0.38	0.32
Total lime (CaO) . . . . . »	7.96	10.66	10.44	12.77	17.47	16.86	25.77	12.71	9.38	11.31
Soluble lime . . . . . »	3.53	5.04	4.69	5.81	10.22	7.98	16.73	5.68	2.73	3.57
Potash (K_2O) . . . . . »	4.48	6.15	6.32	3.67	3.74	3.77	3.40	3.08	2.21	2.35
Phosphoric acid . . . . . »	1.52	1.69	1.30	1.49	1.24	1.28	1.05	1.11	1.09	1.07

Analyses : Nos. I, II, III : North-eastern and eastern region; No. IV: Central region; Nos. V, VI: Western region. — S = Soil; S' = Subsoil.

half of the Pampa, the judicious application of dry-farming methods on the less sandy soils might yield some results, but they ought to be combined with natural wind-breaks (such as rows of trees) in order to diminish as far as possible the violence of the prevailing dry winds and the excessive evaporation which they cause in these very loose soils ; the windbreaks would also prevent within certain limits the blowing away of these soils so wanting in cohesion and kept loose by the repeated tilling which forms the basis of this system. Up to the present no experiment has been made to throw light on this interesting subject.

In the subsoil of the Pampa the layer of " tosca " also occurs as in the neighbouring provinces, but in general only at a slight depth, which also contributes to render farming often problematical even in the best parts (1). Table V shows analyses of soils from this territory.

Province of San Luis. — The characters of the western half of the Pampa territory prevail in the southern part of the province which borders it to the north, namely San Luis, and on an area which may be roughly estimated at 2 ½ million acres. This province, the total area of which is 18 258 000 acres, is situated to the west of the province of Cordoba ; in the centre of the northern part there is an important group of mountains separated from the above-mentioned province by a broad valley which in its turn is limited on the east by the Sierra de Cordoba running north and south and marking the boundary between the two provinces. This valley is furrowed by numerous small streams descending from the neighbouring mountains ; it offers to farming, or rather to stock breeding, an area of about 500 000 acres ; to this may be added an extension towards the south as far as the Rio Quinto, which starts from the south end of the mountains and flows in a south-easterly direction to lose itself in the south of the province of Cordoba ; the whole area amounts to 1 250 000 acres.

The soils of this plain are somewhat different from those hitherto described (see Table VI). They are for the most part light and very permeable, with a rather high lime content, sometimes reaching 50 per thousand ; they all contain small quantities of gypsum and are rich in potash, well provided with phosphoric acid and frequently fairly rich in nitrogen. They rest on a subsoil very nearly resembling the soil, and the content of sand increases with the depth until the water-table is reached. This is situated at a variable depth below the surface, but often sufficiently near it to be able to keep the subsoil moist, which greatly favours vegetation. Where sufficiently moist, these soils are excellent for Leguminosae in general ; lucerne grows luxuriantly and almost indefinitely (2).

Continuing towards the south, but always in the part adjoining the province of Cordoba, the soil becomes more and more sandy with a clay content between 7 and 2 per cent. It is fairly rich in lime, but poor in nitrogen on account of the scanty covering of natural vegetation ; nevertheless in some localities and for considerable extents lucerne thrives very well

(1) Nevertheless lucerne is grown on nearly a million acres.

(2) It occupies about 450 000 acres.

TABLE VI. — *Analyses of Soils. Province of San Luis.*

	I		II		III		IV	
	S Yellow-brown	S' Yellow-brown	S Gray	S' Gray	S Yellow-gray	S' Yellow-gray	S Reddish gray	S' Reddish gray
Fine gravel . . . . %	0	0	0	0	0	0	0	0
Coarse sand . . . . »	38.20	37.70	50.10	49.90	53.50	50.40	77.50	82.70
Fine sand: . . . . »	48.00	49.04	38.10	39.60	34.60	37.10	19.30	14.54
Total sand »	86.20	86.74	88.20	89.50	88.10	87.50	96.80	97.24
Clay . . . . . »	11.50	11.10	9.00	7.60	8.90	9.10	2.40	1.40
Humus . . . . . »	0.90	0.60	0.90	0.50	0.70	0.70	0.10	traces
Organic detritus and soluble matter . . »	1.40	1.56	1.90	2.40	2.30	2.70	0.70	1.36
Nitrogen . . . . . ‰	1.71	0.98	1.32	0.87	1.45	1.44	0.56	0.41
Total lime (CaO) . »	10.89	15.68	13.47	22.79	22.09	25.26	10.39	10.02
Soluble lime . . . . »	5.60	9.80	11.34	18.82	16.80	19.94	1.68	1.33
Potash (K_2O) . . . »	9.06	8.74	8.00	7.10	8.08	8.64	2.99	2.89
Phosphoric acid . . »	1.62	1.49	1.59	1.54	1.69	1.73	1.15	1.34

Analyses: Nos. I, II: North-eastern region; No. III: Eastern region; No. IV: South-eastern region
S = Soil; S' = Subsoil.

owing to the moisture of the subsoil, due as in the northern part to the proximity of but slightly saline subterranean water.

This eastern part of the province of San Luis, bordering on that of Cordoba, is about 3 450 000 acres in extent; with the plain described above, this makes a total area of 4 700 000 acres, all of which is situated in the rainfall belt of 400 to 600 mm. (16 to 24 inches); but owing to the extreme permeability of the soil and the prevalence of drying winds, the soil soon dries out, so that plants suffer from drought in the non-irrigable parts, which are by far the more extensive. These dry areas are often covered by stunted shrubs (chañares, *Gourlica decorticans*) which protect the sparse and tough grass which grows there against the scorching sun; in these poor pastures sheep are bred, while in the moister lands provided with more abundant vegetation cattle and mules are grazed.

In the mountainous region, an important extent of which is wooded, there are also some very good soils and fertile valleys in which irrigation is possible; the atmospheric precipitations are more abundant than in the neighbouring plains, and consequently vegetation is more vigorous.

All the belt to the west and south-west of the mountain ranges is arid and partly saline; the want of fresh water renders any attempt at farming impossible, especially as the climate is still drier than that of the east of this province.

Province of Mendoza. — Continuing still towards the west one enters the province of Mendoza, separated from that of San Luis by the Rio Desaguadero flowing almost due south. The waters of this river are unfortunately salt and unsuitable for irrigation or for watering live stock. This province has an area estimated at 36 160 000 acres, but notwithstanding the good quality of the soil which forms the plain stretching from the above river to the foot of the Andes, only a small proportion of its acreage is under cultivation ; this is due to the extremely dry climate, which does not allow of any farming without permanent irrigation. The western part of this province is occupied by the chain of the Andes up to the summits, which form the frontier between Argentina and Chile; all this mountainous part is arid with the exception of an occasional unimportant valley watered by a stream and used as pasture for stock; the rest is absolutely bare of vegetation. From the immense glaciers of the Cordillera descend numerous torrents, which combine before issuing into the plain to form several important rivers ; the largest of these is the Rio Mendoza, whose waters, particularly abundant during the hot season, are to a great extent utilized for irrigation, supplying most of the land at present cultivated in the province.

In the plain bordering the Rio Desaguadero, which extends for a breadth of sixty to seventy miles, there is no cultivation except on a strip reaching across the province on each side of the Pacific railway, where the waters of the rivers Mendoza and Tunnuyan are made use of.

In this plain the soil is sufficiently calcareous, and contains also considerable quantities of gypsum; it is well provided with other elements of fertility except nitrogen, which is deficient on account of the scantiness of the natural plant covering. The soil, 8 to 10 inches deep, is generally loamy, but sometimes sandy ; the subsoil is almost always more sandy and at a greater depth becomes pure sand, which in its turn rests on a stratum of rolled pebbles of considerable thickness. Over such a permeable formation, the volume of the streams descending from the Andes naturally diminishes rapidly, and they completely lose themselves at a relatively short distance from the Cordillera ; this circumstance greatly reduces the importance of the irrigable belt. Like the adjoining country of San Luis, this vast plain is partly covered by shrubs (chañares); it contains also, especially towards the north, considerable saline areas.

In the portion near the Pacific railroad, water is found at a small depth (15 to 30 feet), but it is almost always more or less brackish. As the town of Mendoza is approached, following the same railway line, the character of the soil changes sensibly ; there is a large extent of alluvial deposits of a rather calcareous nature, generally more so than those forming the plain; the soil is also more compact, being somewhat heavy, or at any rate loamy, with a clay content attaining 10 to 15 per cent. ; this land is permeable and easily cultivated. The depth of soil varies between 12 and 32 inches; the subsoil is more sandy and often rests on gravels, under which, as in the plain, there is a pebble bed of great thickness. (See Table VII).

TABLE VII. — *Analyses of Soils. Province of Mendoza.*

	I		II		III		IV		V		VI
	S Ye owish gray	S' Yellowish gray	S Yellowish gray	S' Yellowish gray	S Yellowish gray	S' Yellowish gray	S Reddish gray	S' Reddish gray	S Yellowish gray	S' Yellowish gray	S Gray
Fine gravel . . . . . %	0	0	0	0	0	0	0	0	0	0	0
Coarse sand . . . . . »	51.51	58.56	70.88	55.39	63.45	76.81	61.85	75.51	81.25	83.86	75.40
Fine sand . . . . . »	34.07	29.04	18.28	30.58	29.58	18.96	28.50	16.10	13.30	11.75	21.72
Total sand . . . . . »	85.58	87.60	89.16	85.97	93.03	95.77	89.35	91.61	94.55	95.61	97.12
Clay . . . . . »	12.20	10.82	8.40	11.55	4.28	2.50	8.21	6.00	2.96	2.72	2.20
Humus . . . . . »	0.15	traces	0.20	0.15	0.50	0.50	0.20	0.10	traces	traces	0.10
Org. detritus and soluble matter »	2.07	1.58	2.24	2.33	2.19	1.23	2.24	2.29	2.49	1.67	0.68
Nitrogen . . . . . ‰	1.05	0.84	0.70	0.56	1.40	0.60	1.81	0.49	0.30	0.24	0.36
Total lime (CaO) . . . . »	41.21	31.19	45.58	33.54	25.14	25.20	13.61	12.18	20.72	22.79	22,45
Soluble lime . . . . . »	25.10	20.23	26.13	19.60	18.30	17.42	6.58	10.86	14.56	16.73	6.79
Potash (K_2O) . . . . . »	5.34	5.32	4.28	4.95	4.32	3.98	3.65	3.92	3.46	3.86	5.72
Phosphoric acid . . . . . »	1.92	1.76	1.83	1.96	1.73	1.34	2.02	1.60	1.46	1.34	1.65

Analyses Nos. I, II, III : Vineyards; Nos. IV, V, VI: Cordillera foothills. — S = Soil; S' = Subsoil.

Vine growing is extraordinarily developed in this province, where the conditions are extremely favourable to it. Soil and subsoil suit the vines perfectly and these give high yields without manuring. The average yield is 4 to 5 and even 8 tons per acre, and what is very important the dry climate protects the vines against the attacks of fungus diseases. It is the most important vine-growing centre of the country ; at present it embraces about 150 000 acres (1) of vineyards, of which about two-thirds are situated on the alluvial land described above ; this part is irrigated by water from the Rio Mendoza.

Further south, but still following the foothills, the soils become gradually more sandy, and are cultivated only where irrigation is possible ; they bear vineyards, fields of lucerne (2) and grassland devoted to breeding and to the keeping of the mules and horses required for the wine industry.

During the last few years fruit growing has made a vigorous start and tends to develop from year to year ; olives especially give good results. This is a region with a great future before it; its cultivable area cannot be estimated at present, as it depends upon the irrigation works to be made, both in completion of those at present existing and to tap the other streams running into it. Some important colonies have been lately founded and they are all prosperous. Fruit growing is mostly practised and also sylviculture, while important works are being carried out with the object of increasing the irrigable acreage.

Province of San Juan. — Conditions of climate and soil closely resembling those described above are met with in the neighbouring province of San Juan, situated to the north of the province of Mendoza. The area of this province is estimated at 21 563 000 acres, but it is very mountainous ; its soil in general is sandy and its subsoil very permeable, so that no cultivation is possible without irrigation. Only the bottoms of some valleys favoured by the presence of streams are cultivated ; unfortunately these watercourses are of no great importance, except of course the Rio San Juan passing by the town of that name, situated in the south of the province and like Mendoza near the Cordillera.

It is thus in a belt of relatively small extent round the town that most of the cultivated land lies ; this is especially given up to vineyards, which, while they do not cover an area as extensive as those of the province of Mendoza, yet follow them immediately in point of importance in the whole country.

These vineyards occupy an area of 75 000 acres ; they produce wine and raisins. Fruit growing is also beginning, but it does not seem destined to develop to the same extent as in the neighbouring province of Mendoza On the whole it is not a very populated region, but one which tends to improve considerably from an agricultural point of view within the area capable of irrigation, which will always be relatively restricted, owing to

(1) In 1887 the area of the vineyards was 11 660 acres; in 1909 it reached 74 630 acres, and at present it is 150 000 acres, which yield about 88 million gallons of wine.

(2) In this province 230 000 acres are under lucerne.

the small amount of available water ; further the extreme permeability of the soil and subsoil necessitates abundant and frequent watering (1).

Province of Santiago del Estero. — Lastly, in order to complete the description of the immense plain which forms the most important part of the Argentine from an agricultural point of view, there remains to be mentioned the province of Santiago del Estero, situated to the west of the province of Santa Fé and to the north of that of Cordoba. It is a considerable extent of plains (35 250 000 acres), traversed by a few watercourses, of which the two most important, the Salado and the Dulce or Saladillo, run parallel to each other towards the south-east.

In the whole province the only interesting part is that lying between these two rivers or near them. In the south-west are enormous salt deposits and salt lands, and the same occurs also in the north-east ; they are almost desert, on account of the want of fresh water on the surface and in the depths of the soil. The climate of this province is dry and the scanty rains fall during the summer from the end of November to the beginning of May, when the temperature is often excessively high.

The arable land of the part mentioned above as the best, consists for the most part of deep, light or loamy, sometimes somewhat heavy soils ; the subsoil does not differ much from the surface soil. The composition varies from place to place : in the more humid parts occur soils rich in humus and nitrogen ; their lime content is frequently high (10 to 50 per 1000 and sometimes even more), but a singular and general feature is their richness in potash, which is rarely below 5 per 1000 and reaches as much as 12 per 1000, while in many soils it is between 8 and 10 per 1000 ; it is the same with phosphoric acid, which rarely falls below 1 per 1000 and attains 3 per 1000, in many cases ranging between 1.50 and 2.35 per 1000.

This region is thus not without some very interesting soils, but it is impossible at present to estimate their extent ; they are unfortunately intermingled with more or less salty areas which would require a special treatment to eliminate the excess of soluble salts they contain ; this would be possible only by means of irrigation. It is in this connection that the difficulty arises, since the waters of the two rivers, the only available ones, are rather unsuitable for this purpose, throughout the whole of their course ; they gradually get charged with chloride and sulphate of soda, of which salts they already contain a certain quantity on entering the province.

(1) In spite of this there are already 136 000 acres of lucerne.

The Testing of Calculation according to Kellner's Starch-Values in Practical Feeding in Germany

BY

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Calculation according to starch-values had its origin in Germany and the method is less known to the agriculturists of other countries, for which reason I will first give a brief account of the principles of this system of calculation.

The important bearing of the laws of energy upon the physiology of nutrition was recognized from the results obtained by RUBNER in Berlin and ATWATER in the United States, and was also confirmed by other investigators. Further, O. KELLNER followed in an admirable manner the transmutation of energy which takes place during the assimilation of food by farm animals, especially in the case of oxen during fattening. N. ZUNTZ and his fellow workers have turned their attention to the relation existing between food energy and the amount of work done by horses.

Animals take up chemical energy with their food. Those portions are useless which pass through the intestines and are ejected, as are also the substances which are removed by the urine in the form of incompletely decomposed organic compounds. We may designate as " gross energy " the total energy content of the food minus the energy content of the excreta, the urine and the intestinal gases. In order to obtain the " net energy " from the " gross energy " it is necessary to make several deductions from the former, in particular for the work of chewing and digestion, including the mechanical work of taking in nutritive substances, and impelling indigestible substances through the digestive canal. In the case of ruminants, in which this is of especial importance, the chief loss is caused by the crude fibre of the food ; for each kilogram of crude fibre eaten, an expenditure of 1360 calories is necessary on an average ; and the energy content of the digested portion of the food is decreased by this amount. The net energy is used by the animal in the maintenance of life, especially in the movements of the heart, lungs and the various body muscles, as well as for the conversion of vegetable food into animal substance, *viz.* the transformation of carbohydrates into fat, and of protein into flesh, blood, milk, etc. Part of the net energy is also made use of by the bacteria living in the intestines and the rumen.

Whatever net energy remains to be of practical use to the agriculturist, we call " stored energy ", *i. e.* all the energy which is laid up in the form of flesh, fat, glycogen, etc. Milk can also be reckoned in, for as is

well known, this is made from certain substances taken up by the small glandular cells of the udder (with the assistance of the nerves) from the blood and the lymphatic vessels, and which temporarily serve to build up the gland cells.

The work of science is to ascertain how much of the gross energy of the food passes over into " stored energy ". In this direction, O. KELLNER has done prominent work as regards the fattening of adult ruminants. He was doubtful as to the best word to be chosen for the use of the practical farmer to express the ascertained " stored energy ". The educated farmer knows the meaning of starch, fat, protein, etc., but Kellner considered that the term " stored energy " (" Ansatz-energie ") would be beyond his comprehension and chose another way of expressing the idea.

In fattening, fat is made from starch, about 2360 energy values (calories) being stored up in the body for every kilogram of starch taken in. Kellner took the number 2360 as a unit, called it=1, and gave it the name of "starch-value ".

The amount of energy derived from protein, fat, sugar, etc., and stored up in the body can be referred to this unit, and in this manner the starch-values of the various other nutritive substances and feeds can be calculated. For instance, 1 kg. of digestible protein has in fattening a starch value of 0.94, and 1 kg. of fat in oil-cakes has a starch value of 2.41.

M. RUBNER had already ascertained that digestible food stuffs are isodynamic, and that every foodstuff can be reduced to a unitary basis by calculating the energy value (calories). Further, it is necessary to pay attention to the amount of the digestible protein, for this cannot be replaced by fat and carbohydrates. In addition to ascertaining the starch-value ("Ansatz-energie"), it is thus necessary to be sure that a certain amount of the starch-value exists in the food in the form of protein.

a) *Fattening with regard to starch value.*

A number of fattening experiments with oxen and pigs were carried out under the conditions obtaining in practical farming, definite numbers of starch values being fed. Oxen were undertaken by G. ANDRAE at Braunsdorf and W. SCHNEIDEWIND at Lauchstädt. Pigs were dealt with by J. HANSEN, W, SCHNEIDEWIND, THIELSCH and others. The reports showed without exception that the rations determined according to Kellner's starch values were correct, and that this method of reckoning the amount of food required was preferable to all other systems.

This practice will become more general in Germany in the future than it has been hitherto.

b) *Feeding of milch cows with regard to the starch value of the feed.*

Of late years, the Control Associations have taken a leading position in Germany respecting the feeding of milch-cows, as far as the application of scientific experience to practical methods of agriculture is concerned. Some of these Associations calculate according to starch-values and others according to " food units ". The last-named method was adopted from Denmark and Sweden, and is based on the work of FJORD and FRIES in Copenhagen ; these workers ascertained that a milch-cow must consume 1

kilogram of rye, rye bran or wheat bran, in order to produce 3 kilograms of milk. Forother feeding-stuffs similar results were worked out, giving substitution-figures for rye etc.; the amount which was equivalent to 1 kg. of rye was called a " food unit ". The amount of many foods which constites a food unit has since been altered as a result of practical experience, especially after Kellner made known the starch-values. The differences between starch values and food units have now been adjusted. The value relation is: 1 food unit = 0.605 starch-value = 1430 " stored energies ". There is therefore no reason to retain in future the term food unit (which was only used in one part of Germany). For my part, I should suggest that in the different feeding systems the number of " stored energies " should be internationally substituted for starch values (which were introduced for calculating the increase in fat during the fattening process).

Most of the Control Associations in Germany reckon according to starch values. Further, numerous feeding experiments under the conditions of farming practice have been carried out on the basis of starch-values, *viz.* those of J. HANSEN, G. ANDRAE, THIELSCH, VON KNIERIEM and BUSCHMANN, MORGEN, BEGER, WESTHAUSER. All agree that reckoning starch-values (" Ansatz-energien ") is far more satisfactory than the old method of calculating from digestible food materials.

Those practical farmers in Germany who carry out such calculations, make use of starch-values or food units ; they reckon therefore, though for the most part unconsciously, according to stored energies, since these three methods of calculation are comparable with temperature returns on the Réaumur, Fahrenheit and centigrade scales. The figures given are different, but the same amount of heat is expressed; in our case, the amount of energy is equal, but the figures are different.

With regard to the feeding of milch-cows, there is still a difference of opinion as to what proportion of the starch-values mustbe given in the form of digestible protein.

Formerly WOLFF nd MÄRCKER reckoned that a cow must consume 90 gms. of digestible protein to produce 1kg. of milk. KELLNER in 1905 reckoned the amount at from 60 to 75 gms., and from 1906 at only 45 to 57.5 gms., the smaller amount in the case of lower, and the greater in that of higher, milk yield. The Swedish, Danish and Schleswig Control Associations calculate, according to the proposal of NILS HANSSON, 45 gms. of digestible protein for every kg. of milk, without any regard to the amount of milk produced. Each cow receives in addition as maintenance ration 325 gms. of digestible protein per 500 kg. of live-weight.

NILS HANSSON in Stockholm rightly points out that the experience acquired by Kellner respecting the protein required in fattening cannot be used in the case of milk production, since greater transmutations of substances and energy take place in transforming food protein into flesh or into nitrogen containing connective tissue than in transforming it into the nitrogenous components of milk (1). In the latter case, the molecular

(1) See No. 42, *B.* Jan. 1914. (*Ed.*).

redistribution is less and the food protein is utilized better. This view coincides with the results obtained by JORDAN at Geneva (New York); he found that when the food contained little protein 90 to 95 per cent. of the quantity over and above that required for the maintenance of the animal was transformed into milk, while with larger quantities of food protein, much less of the latter was used for the purpose of milk production.

According to the wide experience of the Scandinavian Control Associations, it would be highly desirable to diminish the amount of protein prescribed by Kellner, unless any special reason exists for giving a large quantity. From the practical point of view the matter is of importance in that protein is an expensive food material. It must be decided independently of the general question as to whether reckoning according to starch-values has proved satisfactory. This question can, without doubt, be answered in the affirmative for Germany.

Trials of Agricultural Machines in Sweden

by

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HISTORICAL.

The first official trials of agricultural machines made in Sweden were organized by the Royal Academy of Agriculture, which celebrated its centenary in 1913, and by the societies of Rural Economy. The latter, almost all of them founded at the beginning of the nineteenth century, are 26 in number, or one and sometimes two in each province.

The Academy of Agriculture organized in 1874 a trial on a large scale of threshing machines and mowers on the occasion of an agricultural show, but as a rule the machines which competed for prizes in the Swedish General Agricultural Congresses ("Allmanna Svenska Landtbruksmotena") were not submitted to trials. The agricultural congresses, which include the whole country, are held every five years in different parts of the country; at those of 1886, 1891 and 1896 certain groups of machines were tried by means of funds which on each occasion were appropriated by the State for this object.

In proportion as the demand for machines grew and the offer of the Swedish and foreign manufacturers grew still more, it became necessary that in the choice of a machine, the agricultural public should have a more reliable guide than the prize judgment based only upon ocular inspection; hence arose the need of submitting to an exhaustive test the working of every machine exhibited at the Swedish general agricultural shows; for this purpose the establishment of permanent trial stations, working uninterruptedly, became necessary. The manufacturers themselves demanded the institution of these stations with the expectation of obtaining useful information for the work

of construction. As a matter of fact it was in consequence of a donation of 100 000 crowns (£5 500) made by one of our largest agricultural machine manufacturers (The Separator Joint Stock Company) that these institutions were started. According to the deed of donation there was to have been one trial station in each of the agricultural institutes of the country: at Ultuna in Central Sweden, exclusively for agricultural machines, and at Alnarp in Southern Sweden for agricultural and dairy machines; the trial of machines in one of these establishments was to be one of the conditions to be fulfilled before they could be exhibited and entered for the prize competitions at the agricultural congresses ; it was calculated that the capital given, with the interest and the fees fixed for the entries to the trials, would have been sufficient for a little over ten years.

The regulations were drawn up in 1897 and when, almost at the time that had been foreseen, the fund was exhausted, the State granted from year to year the necessary sums with which to continue the work. In 1912 the Stations were reorganized. New regulations were introduced at the beginning of 1913, under which the State subvention, which is appropriated only year by year, amounts to 21 000 crowns (£1155).

Organization.

The Trial Stations have a common board of management which deals with all the business of general interest, such as the tariff of fees for the trials, the budget of the work to be done, the nomination of certain members of the trial committees, etc.; but each of the Stations has a special committee which carries out the trials. Originally the director of the Institute and the professor of machine building were *ex officio* members of the commitee, as well as the manager of the Institute's farm or the professor of dairying (for the part concerning dairy machines) ; besides the above, an engineer and a practical farmer or dairy manager are nominated members of the testing committee. With this system the Stations worked independently of each other, and there was a danger of different principles being followed in judging. Further, the drawing up of the reports being entrusted to persons whose time was taken up by their regular work, it happened sometimes that the trials as well as the reports concerning them would be put off for a long time. In order to avoid these drawbacks, since the reorganization of 1912 one director has been nominated for the two Stations at a salary which enables him to devote all his time to the trials and to the drawing up of reports. The directors of the institutes do not belong any longer to the committees. An assistant to the director and a mechanic are permanently appointed.

Method of working adopted by the Trial Stations.

The trials include: machines already on the market (in this case the report of the trial must be published, whatever the conclusion may be); and machines under experimentation but not yet offered for sale: in this case

the maker has the right to demand that the results of the trial should not be published. The trials of this class are naturally not so frequent as those of the first, as when a maker has brought a machine to the point of being tried he is usually anxious to begin selling it.

The trials are the following:

a) *Trials in series*, comprising whole classes of machines: they are generally organized every year for one or two classes of machines by the board of the Trial Stations and are free of charge.

b) *Individual trials*, for which a fixed fee is paid, are made at the request of farmers, or the manufacturers or vendors of the machines.

c) *Trials undertaken on the initiative and at the expense of the Trial Committees*; they refer to machines which it appears desirable to make known.

Owing to the great numbers of trials of classes *a*) and *b*), only a few of class *c*) have so far been made.

It is formally stipulated that the machines submitted to trial must not be built differently from or with more care than those of the same type already on the market, and the Committee has the right of selecting in a vendors' store the machine of the type that has been entered for trial.

The person who enters a machine is obliged to be present at the trial, or if unable to attend, he must provide someone to represent him. He may, if he thinks fit, make preliminary trials until the machine is declared ready to be submitted to the trial proper; when a machine is entered by a person other than the maker or his delegate, or when the trial is made on the initiative of the Committee, the maker must, if possible, be informed of the date of the trial, and he has the option of being represented. Besides the parties interested, no one has the right to be present at the trials without the Committeés authorization.

According to the tariff at present in force, the entrance fee, when one is due, is based upon the price of the object tested; it varies from 10 to 75 kroner (11*s* to £4 2*s* 6*d*) according as the price is below 50 kr. (£2 15*s*) or between 750 and 1000 kr. (£41 5*s* and £55); if the price is above £55 the fee is increased by 5 per cent. of the amount above this sum.

The features chiefly considered at the trials and in judging the machine are: *construction, quality of material, make, durability, capacity for work, quality of work done, consumption of power, facility of handling*, as well as the *price* if it deserves notice from some point of view. The question of judging by points has been much discussed and this system has sometimes been followed; but on the one hand it is impossible to determine the relative numbers of points for the various qualities, and on the other hand a high final number, by which a buyer without critical sense might be tempted to be guided, might be the result of qualities which in certain respects are of no importance for some buyers, whilst the machine, for some other quality might not suit them. Thus the verdicts on the machines are given only in words on the points mentioned above and on some others which might have some weight in forming an opinion on the machine, but which would not have any on the final number in the case in which points are given according to a fixed scheme.

In order to judge most of the characters mentioned above, the Trial Stations possess the necessary instruments and tools, especially for measuring the consumption of power; for testing the materials it is often necessary to apply to the material-testing workshop of the Technical College in Stockholm. For the calorific value of fuels, recourse is always had to this College.

In most cases the trials are conducted on the farms of the agricultural institutes, where special constructions have been erected for the Trial Stations and where it is possible, on payment, to have the necessary labour, teams and power. When necessary the trials are made in other localities and not at the Institutes of Alnarp and Ultuna. The makers of the large motors avail themselves more than others of this concession, because for them the trial in their own works, notwithstanding the travelling and other expenses and a higher fee paid to the members of the committee, is cheaper than sending the machines to the Trial Station.

For many machines, further trials, called the long trials, are held after the principal trials in the presence of the Committee are finished. Their object is to demonstrate better the durability and facility of handling in ordinary farming; after these trials, the machines are examined and the manager and the farm hands report their experience of the use of the machine.

Publication of the Results of the Trials.

Detailed reports of all the trials are drawn up; they include: the *description* of the object tried, the *account of the trial,* and the *judgment.* When several machines of the same class are tried at the same time, as in the trials by series, parallel comparisons, as far as possible in the form of tables, are made of the special characters of the machines and the results of the trials. In cases in which the reports are not to be published, but only communicated to the person who has had the trial made,the description is limited to what is strictly necessary to characterize clearly the machine or implement, so that if the trial is repeated it should be possible to see in what respects its construction has been modified. In the series trials these reports may be completed by a chapter on the group of machines examined, and also by special detailed tables with the results of the comparative trials used as a basis for the judgment, etc.

It is always sought to give the final verdict in a concise form and to draw it up in such a way that the maker can insert it in his prospectus and advertisements. When the Trial Stations learn that a judgment has been published with suppressions,or in such a way as to be misleading, they are bound to have the error publicly rectified.

The reports which are to be published appear in the Bulletin of the Board of the Trial Stations (*Meddelande från Styrelsen för Maskin och Redskapsprofningsanstalterna*). The first of these Bulletins, reporting the trials made in 1898, appeared in 1899; up to September 1913, thirty-six Bulletins have been issued, in which a total of 3352 pages represent the

reports of the trials. Some of the earlier Bulletins were rapidly taken up and are out of print, but reprinting *in extenso* reports on machines some of which are out of date did not seem necessary, and in 1910 a summary of the first ten Bulletins was given in a volume of 300 pages.

Conclusion.

It is beyond discussion that the work of the Trial Stations has been of far-reaching importance for Swedish agriculture and for the Swedish machine industry. The extension of the movement bears ample testimony to its value. The power of the Trial Stations lies in the minuteness of the valuation and in the conscientiousness with which the trials are conducted. If the new organization allows the results of the trials to be more promptly known, a desire frequently expressed by machine builders and vendors will be realized.

A proof of the great importance attached by all to the trials is the fact that when an agent of a manufactory offers an agricultural machine to a merchant, the first question that the latter usually asks is " What is the opinion of the Trial Station " ? And if the machine has never been presented to the Stations, the negotiations are generally broken off with the words : " Come again when the machine has been tried ". It has often been noted that the largest American firms have taken into consideration the verdicts of the Swedish trials and have introduced into certain machines the modifications suggested by the trials.

Present State of the Dairying Industry in Canada.

by

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Dairy and Cold Storage Commissioner.

According to the census of 1911, these were 2 594 179 cows in Canada that year. This was an increase of 185 502 as compared with the census of 1901. The increase was all in the Western Provinces. In all of the five Provinces east of the Great Lakes there was a small decrease in the number of cows during the decade. The number of the cows, however, is only one of the factors which affect the production of milk, for we find that while the value of the total product in 1900 was $ 66 470 953 it had risen to $ 109 340 000 in 1910. In other words the increase in the number of cows during the decade was only 7 per cent., while the increase in the value of the total product was 60 per cent. In Ontario, where there was a decrease of 3 per cent in the number of cows, the value of the product increased by 18 per cent during the same period ; in the Province of Quebec, with a decrease of nearly 2 per cent. in the number of cows, the value of the product increased nearly 35 per cent.

In 1900 the value of the total product was $ 27 per cow and in 1910 it was $ 42 per cow. Part of this increase in value must be attributed to a 10 per cent. higher price in the latter year and to the fact that a larger proportion of the total product was sold as market milk, but even after these allowances are made, the figures show a very substantial gain in milk production.

The increase in the yield per cow resulting from better management of the herds is mostly clear profit, and it is only fair to add that much of th e credit for this result is due to the cow-testing propaganda carried on for the last 8 or 10 years by the Dairy Division of the Dominion Department of Agriculture. The farmers are encouraged to test and weigh the milk of the individual cows in their herds in order that the unprofitable ones may be eliminated and the herd built up by rearing the progeny of those that have the best records. This work has only just begun and it is a fair presumption that by the time the next census is taken a still greater increase will be shown.

Figures for the total value of dairy production in 1913 are not available, but if we take the figures already quoted from the census of 1911, which give the value of total products in 1910, and allow the same rate of increase as there was between 1900 and 1910, the value for 1913 is approximately $ 122 000 000.

The value of the different products in 1910 (Fifth Census) was as follows :

Factory Cheese.	$ 21 587 124
Home-made Cheese	153 036
Creamery Butter	15 645 845
Home-made Butter	39 889 953
Condensed Milk.	1 813 971
Milk and Cream consumed as such, or used for Ice Cream	30 250 005
Total	$ 109 339 934

Canadian Cheese.

The cheese manufactured in Canada is almost entirely of the one kind, resembling more nearly the English Cheddar than any other variety. The Canadian cheesemakers adopted this type of cheese as being the one best suited for the factory system, and because the taste in England, where they looked for a market, was demanding cheese of that character. Canada has not, like most other countries, developed a special type of cheese of any importance. A few families on the Island of Orleans make a limited quantity of a small, soft, highly fermented cheese, which is sold in Quebec City. The process of its manufacture is either a modification or an unskilful imitation of the method employed in making some of the old French varieties, and was first practised in Canada by French colonists early in the 17th century. A few foreign varieties have been introduced, like the Port-du-Salut (French) made at the Trappist Monastery on

the Ottawa River and sold as " Oka " cheese. There are several brands of " potted " cheese on the market, but these are prepared from ordinary Canadian Cheddar.

Condensed Milk and Milk Powder.

The manufacture of condensed milk and milk powders is becoming an important branch of the dairy industry in Canada. There are 12 large factories engaged in preparing these products, and the number is likely to be increased. A total of 69 264 090 pounds of fresh milk was used for this purpose in 1910, out of which there was manufactured 27 831 596 pounds of finished products. The quantities are much larger at present, but the exact figures are not available. The principal seat of this industry is in Western Ontario, and the milk thus diverted from the cheese factories, together with the milk and cream sent to city creameries, is rapidly diminishing the output of cheese in that district. The condensed milk is nearly all disposed of in the Western Provinces.

The Ice Cream Trade.

The quantity of ice cream consumed in Canada has increased enormously during the past five or six years, and its manufacture is an important and a growing factor in the disposal of the milk supply of the country. Statistics gathered from ice cream manufacturers in only 24 towns and cities in 1912 showed that they used the equivalent of over 2 000 000 pounds of butter for this purpose. Instead of being looked upon as a luxury or a confection, ice cream is coming to be considered as a food.

The Export Trade.

Small quantities of butter and cheese have been exported from Canada for over one hundred years, but it was not until about the middle of the nineteenth century that a regular trade of any importance was established. The maximum export of 34 128 944 pounds of butter was reached in 1903 and the largest export of cheese, namely 233 980 716 pounds, was in the year 1904. After 1907 the quantity of butter exported declined rapidly, until in the fiscal year ended March 31st, 1913, less than one million pounds were exported to all countries, and for the first time in over 60 years practically no butter was shipped to Great Britain, the actual quantity being only 681 pounds. The exports of cheese for the fiscal year ended March 31st last were 155 216 392 pounds. In the year 1900, 37 per cent. of the total dairy production was exported, while in 1910 the exports were only 21 per cent. of the total production. The decline in the exports of dairy products in the face of the increase in the production of milk is partly the result of a larger per capita home consumption, owing to the prosperous condition of the people and the improved quality of milk, butter and cheese offered for sale, but it is chiefly due to the large growth in population during the past 10 years.

Comparative Value of Detailed Exports.
for Years ended March 31, 1909 *to* 1913.

	1913	1912	1911	1910	1909
	$	$	$	$	$
Cheese	20 697 144	20 888 818	20 739 507	21 607 692	20 384 666
Butter	223 578	2 077 916	744 288	1 010 272	1 521 436
Condensed Milk	25 554	305 678	469 406		
Fresh Milk	1 412	975	4 276	541 372	90 520
Cream	751 123	792 687	1 714 528		
Casein	15 342	38 302	37 009		
	21 714 153	24 104 376	23 709 014	23 159 336	21 996 622

The Factory System.

Although there were over one million cows in British North America in 1861, the outlook for dairying at that time was not encouraging. Progress was impossible under the conditions which then existed. Cows were kept in most cases as a sort of side line and very few farmers specialized in dairying. The production of milk for cheese or buttermaking was limited to the amount of time which the farmer's wife and daughters could spare for that purpose from their other and ofttimes arduous duties, and the supply of dairy products so far exceeded the local demand that prices were unremunerative.

The introduction of the factory system of manufacturing cheese and butter saved the situation by making an export trade possible and opening the way for an increased production of milk with greater profit to the farmer. The first cheese factory in Canada was established in the province of Ontario, in 1864. During the following year, a cheese factory was opened in Quebec. The number of factories increased rapidly in Ontario until about the year 1900, when the suitable territory was fairly well occupied. In Quebec there was not so much progress until after about 1883.

The first creamery in Canada was established in the Province of Quebec in 1873. The organization of other creameries immediately followed in both Ontario and Quebec and later in the other provinces, but there is still a large quantity of butter produced on farms in some districts. There is practically no cheese made on farms in Canada.

The comparatively sparse settlement and small number of cows kept within a reasonable radius of any given point have so far made it impossible to secure sufficient milk to put the cheese factory on a self-sustaining basis in the territory west of the Great Lakes, except in some parts of Manitoba. The result has been that the cream-gathering creamery, whose operations

may be extended to a very wide territory, has been adopted as the most suitable form of the factory system for that part of the country. In this system the farmers who support the establishment provide themselves with hand-power cream separators, and send the cream only to the factory. The cream is delivered over long distances every second or third day, and thus a large saving is effected over the cost of delivering milk every day. As the milk must be delivered early in the morning the area from which it is obtained is necessarily much smaller than in the other system.

Cheese Factories and Creameries in Canada.

The latest returns show that there are 3760 cheese factories and creameries in Canada, and 112 condensed milk or milk powder plants. The cheese factories and creameries are distributed by provinces as follows :

Province	Cheese factories	Creameries	Combined factories	Skimming stations
Ontario	1 019	128	59	1
Quebec	894	576	698	125
Alberta	3	53	1	—
B. Columbia	—	23	—	—
Manitoba	18	30	1	3
N. Brunswick	24	17	3	—
Nova Scotia	7	13	1	—
P. E. Island	17	8	19	—
Saskatchewan	2	17	—	—
	1 984	865	782	129

The cheese factories and creameries are not organized on any uniform plan. Many of them are owned and operated by individuals or firms ; other are owned by joint stock companies, the shareholders of which may or may not be milk suppliers.

In the business organization of the factories, either proprietary or joint stock, the milk suppliers are the recognized owners of the product and they usually appoint a salesman, a treasurer and other officers to look afters their interests. In some cases the owner of the factory is appointed salesman.

The owner or company receives a fixed rate for manufacturing, except in very limited districts where the factories are operated on a percentage of the value of the product sold. Where the fixed rate is in vogue, it varies for manufacturing cheese from 1 to 1 ½ cents per pound, and from 2 ½ to 3 ½ cents per pound for butter, according to the locality or the competition between factories for a milk supply.

Recent Work and Progress in the Dairying Industry in Denmark

by

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Thirty years have now elapsed since the economic conditions in Denmark changed to such an extent that the exportation of cereals, which until then had been of considerable importance, fell below the importation of cereals and of feeding stuffs for live stock.

The value of the excess of imports of cereals and foodstuffs over exports has constantly increased during the last thirty years, while the exportation of dairy produce has grown considerably during the same time. The transition from the sale of cereals to the present great sale of butter is especially due to the cooperative dairies. While formerly in each of the large and small cows-keeping farms, about 180 000 in number, butter used to be made, at the present time the whole Danish production of butter is carried on in about 1500 dairies, of which 1200 are cooperative, most of them much larger than the 300 private ones (partly dairies that collect the milk from the producers and partly farm dairies).

In 1882 the first cooperative dairy was founded in West Jutland. A few years previously the cream separator had become a practical machine and was used in some dairies that collected and bought the milk from neighbouring farmers. These collecting dairies, however, as a rule were not successful; they could not pay suitable prices for the milk and did not get enough milk to work up, besides which their produce was often of inferior quality. The cooperative dairies were the first to attain satisfactory results, and they spread in the following years all over the country. Especially between 1887 and 1889 a great number of them were founded, and by 1893 it may be said that the whole country was provided with them.

Each of these cooperative dairies was founded by a group of farmers, who formed a cooperative association, drew up their statutes, elected a managing board, bought building land, bored or otherwise sought for water, built a dairy and a dwelling-house for the staff, bought the necessary machinery and plant and appointed a daiyman who in his turn engaged the necessary assistants.

Every morning the milk is brought to the dairy in hired carts, so that the carriage of the milk is as easy for the producers living at a distance as for those quite close to the dairy. In the dairy the milk supplied by each member is weighed and twice a week its fat content is determined, because it is paid according to its value for butter making. After being weighed the milk is passed through a filter, warmed to 50 to 56° C. (122 to 131° F.) and centrifugated. The cream is immediately pasteurized at 80 to 85° C.

(176 to 185° F.), then cooled and the starter added to it so as to be ready for churning the next morning. Only a part of the skimmed milk is used for making cheese; most of it, on issuing from the separator, is pasteurized at 90 to 95° C. (194 to 203° F.) and then weighed out still warm for the members, to whom it is sent, together with their share of buttermilk, by the milk cart, thus all the members get back their skimmed milk and buttermilk, which they can use in their farms for feeding calves, young pigs, foals or chickens.

The cooperative dairies were principally founded with the object of attaining the complete utilization of the butter-fat contained in the milk of the many small farms, while the manufacture of cheese was but little contemplated. Here and there the new dairies were built and equipped for the making of skim-milk cheeses, but as a rule the greater part of the centrifugated milk, as well as the butter milk, was sent back to the members, and only very few cooperative dairies were induced to take up from the beginning and on a large scale the retail sale of milk.

The production of butter was almost everywhere carried out successfully. Not only was it possible with the aid of separators to extract more butter from the milk, but as a rule the quality of the butter was much better than that hitherto obtained by the numerous small producers, and was consequently sold at very advantageous prices.

The result was that the cooperative dairies enabled the numerous small farmers to produce butter with the profit which up to then had only been possible for large farms; and even poor cottagers who possess only one cow find it profitable to contribute to the increase of the production of milk.

From the table given below, it will be seen how the butter trade has developed in Denmark. The imports include butter from the south of Sweden and from Finland, Russia and Siberia, which is partly consumed in Copenhagen and partly re-exported by Danish steamers. This importation increased up to the begin of this century and is still fairly important, while the exportation increased much more and has continued to grow.

In spite of the remarkable increase of the population of the towns and the greater purchasing power of the labouring classes, the excess of the exports over the imports of butter has increased to a surprising degree. In this connection it must be borne in mind that Denmark consumes every year large quantities of margarine (91.08 millions of pounds in 1912).

The great increase in the production of butter is partly due to an increase in the number of cows (from about 900 000 in 1881 to 1 282 000 in 1909), but principally to better feeding and better selection and breeding of the milch- cows. Since 1887 in the whole country about 1000 cattle-breeding associations have been founded, which promote the systematic breeding, keeping and development of the cattle of their districts by the following means: purchase and use of one or more special bulls for those cows of the members, which are considered suitable for breeding purposes, by instruction in the management and judging of breeding, by taking part in

Danish Imports and Exports of Butter in millions of pounds.

Year	Imports	Exports	Excess of exports over imports	Including milk and cream
1865-69 average	1.17	10.85	9.68	—
1870-74 » . . .	4.03	22.79	18.77	—
1875-79 » . . .	5.43	28.95	23.52	—
1880-84 » . . .	7.61	32.05	24.44	—
1885-89 » . . .	11.88	55.73	43.85	—
1890-94 » . . .	27.81	107.23	79.42	—
1895-99 » . . .	36.65	145.20	108.75	—
1900-04	50.58	195.89	145.31	—
1905	41.80	208.10	166.30	3.10
1906	41.38	208.89	167.51	5.83
1907	40.57	226.86	186.30	6.29
1908	32.71	230.16	197.45	6.16
1909	35.97	233.79	197.82	8.25
1910	30.50	231.40	200.82	12.39
1911	37.62	243.91	206.29	15.22
1912	32.19	234.54	202.36	20.97

cattle shows, by keeping herdbooks, etc. Since 1892 (1), upwards of 500 milk-record associations have been founded with the object of demonstrating the profitableness of cattle breeding and of promoting the formation of lines of cattle capable of yielding a milk richer in butter. The means employed are investigations into the feeding and into the quantity and the fat content of the milk yielded by the individual cows of the members' herds.

As regards the quantities of fodder consumed, it must be noted that while up to the year 1883 the exports of cereals were in excess of the imports and the sale of cereals was an important source of income for both large and small farmers, at present a majority of farmers feed all their crops to their

(1) The first milk-record account with data on the milk and butter yield and consumption of fodder of every individual cow during the year was published in the *Mœlkeritidende*, 1894, pp. 37-40.

stock ; and though considerable quantities of cereals are still sold, the value of bought foods, especially maize, wheat bran and oil cakes, greatly exceeds them, while at the same time the areas devoted to root crops for feeding purposes are steadily increasing. In 1912 Denmark had an excess of importation of maize and other cereals valued at about £ 2 200 000, and of bran, cakes and the like worth £ 4 190 000. At the same time live cattle and beef worth £ 3 113 000 and bacon and other meats to the value of £ 8 327 000 were exported (1) ; further, the better feeding of cattle and pigs produces now considerable masses of manure which serve to increase the productiveness of the fields and diminish the evil effects of unfavourable weather.

The increasing quantities of milk have had the result of rendering the original buildings of most dairies too small for present requirements. In many places buildings had been run up as cheaply as possible for fear of incurring the burthen of heavy interest on the capital of expensive plant in case of a fall in the prices of butter. But as dairying proved profitable and the quantities of milk increased, the means were soon found where with to enlarge the buildings and to provide new and suitable machines and implements.

The constant endeavour is not only to keep the dairies in good condition, but also to equip them always better, so as to be in a position to produce butter of a finer and more uniform quality ; in this respect the publicly appointed consulting experts, as well as two good dairy schools, have rendered most valuable services.

The Agricultural Laboratory of the Royal Veterinary and Agricultural College has also contributed much to the general progress. Further, numerous large and small exhibitions exert an effective control as regards the quality of the butter, and the so-called Farm-Statistics Bureau, which undertakes the elaboration of a number of yearly accounts kept according to a uniform system, has for many years been a useful guide in the economic management of farms. At first it was chiefly the question of the erection of ice-houses and of procuring larger and better steam boilers and engines, and of laying down better floorings and water supply; later came the apparatus for pasteurizing cream and for multiplying the acid bacteria, or the demand for better separators ; now, in recent years, refrigerators, eletric lighting and bathrooms are the items that cause much expenditure.

Instead of the former small cheap dairies, now, in many localities, large dairies with lofty well-ventilated workrooms are to be seen ; they are well provided with steam power, refrigerating plant, electric lighting and such an abundance of good separators and other appliances, that every day two to four thousand gallons of milk are separated in about three hours.

Since 1904, several dairies, especially in the south of the country, have begun to export cream to Germany, whilst most of the butter is now, as formerly, exported to England. This is due to the fact that Germany

(1) The value of the excess of exports of butter, milk and cream amounted in 1912 to £ 11 425 000.

imports ever increasing quantities of dairy produce, and as butter pays a duty of 10 per cwt. while cream is duty free, the importation of cream offers a greater margin of profit, notwithstanding its greater weight. The figures given in the table on page 169 show that the exportation of cream from Denmark has of late years steadily grown.

It must also be mentioned that of late years the production of cheese has been encouraged in many ways. There are not only several milk-collecting dairies which manufacture varius kinds of cheese from whole milk, but also many large cooperative dairies which make cheese partly from whole milk and partly from a mixture of whole and skimmed milk. For many years attempts had been made to manufacture cheese from pasteurized milk; by 1906 there were already 25 dairies that used pasteurized milk in the manufacture of cheese. In many dairies during recent years new and good cheese stores with insulating walls and refrigerating plant have been built in order to protect the cheeses against too much heat in summer. At present about 55 million pounds of cheese are made every year in the country.

The great demand for casein in the year 1910 led to the erection of about 20 casein-drying establishments, to which a great number of dairies delivered fresh casein, so that in 1911 more than 3.3 million pounds of casein, worth 3 ½ *d* a pound, were exported. In 1912 the fall in prices limited the production rather suddenly.

Lastly, it must be mentioned that a few years ago a condensed milk factory was built at Nakskov in Lolland; in 1912 it exported £ 82 500 worth of condensed milk.

Basis of International Statistics of Agricultural Book-keeping

by

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I. Generalities.

For the examination of the economic conditions of farming the methods based on book-keeping give the most complete and reliable results, much superior to those obtained by means of enquiries by question sheets. Recognizing this fact the collection of the results of agricultural book-keeping has been commenced of late years in several States. But in order that the figures obtained from several farms should be comparable with each other, it is necessary that they should be collected and elaborated according to the same methods.

If the results of individual central offices for book-keeping are to be compared with each other, similar conditions must prevail in all. The value of these observations increases the more they can be compared with other

similar material; it is necessary therefore to give them a *uniform basis* from both the scientific and the practical points of view. The sooner uniformity is introduced in this direction, the more easily will the final aim be reached, for as long as this work is in its initial stages it will be much easier to prevail upon the book-keeping offices to adopt uniform methods, while later any modification of methods would complicate matters and interfere with the comparison of later and earlier results.

The following chapters are an attempt to outline the plan to be followed for this unification, and they will discuss the following subjects:

1. Definitions.
2. Valuation.
3. Methods of book-keeping.
4. Closing of accounts.
5. Elaboration of results.

II. — Definitions of the terms used.

The first condition to be fulfilled for the success of the investigation consists in defining the terms employed, and especially the following: *Agriculture* (Landwirtschaft), *Classification of capitals* (Kapitaleinteilung), *Gross product or gross returns* (Rohertrag), *Expenses* (Aufwand), *Net product or net returns* (Reinertrag), *Income* (Einkommen), *Income from whole estate* (Vermögenrente), *Compensation of labour* (Arbeitsverdienst), *Returns from the farm* (Landgutsrente), *Ground rent* (Grundrente), and *Capitalization value* or value based on returns (Ertragswert).

1. — *Agriculture.* The enquiries must bear on the farming. The term agriculture includes not only the cultivation of the soil, but also the working up of the crude products, especially in the form of keeping live stock. Thus accessory industries, such as dairying, wine making, distilling, brewing, sugar making and so forth, also belong to agriculture, in so far as they work up the crude products of a given farm. On the other hand if great quantities of crude products are bought outside the farm so that the industry is no longer bound to the property, it is better to detach the whole accessory industry from the agricultural part and to treat it as a non-agricultural or private undertaking.

The *excavation of peat, gravel* and the like belongs to agriculture in so far as it is carried on chiefly with the object of utilizing fully the teams and labour kept for agricultural purposes. The same may be said of the woods. Large forests, the utilization of which is but loosely connected with the farm, should be separated from the agricultural work, and this especially when the average gross returns of the wood form a considerable part and even more than half of the total gross returns. In the same manner game and fish are to be considered. Pond fishery may always be classed with agriculture.

Trade in agricultural produce must also be separated completely when the property does not contribute its crude products or its teams and labour.

In the latter case the same rules are to be observed as for the accessory industries.

Credits and investment of capital (Kapitalanlagen) and their returns, are not connected with agriculture except in so far as they have originated in produce of the farm or act as a reserve for it.

The private family account or *personal account* (Privatverbrauch) must be separated from the farming account. The farm must not pay interest on those portions of the estate which are used for the family account, which must not be considered in calculating the net returns on the capital, except to the extent that the farm has received compensation for rent or other supplies enjoyed by the private household. The more completely the calculating of such rents can be avoided and these capitals kept apart from the agricultural book-keeping, the more accurate will this be.

2. — *The capitals*. All the parts of one's estate that are used in farming and which concur in producing profits are called *assets* (Aktivkapitalien) of the farm. In describing the assets of a farm, the land and other things rented or farmed by the farmer must be included, in particular the value of the farmed property. If this is not possible, they are to be treated separately and their results kept separate from those of the property, the assets of which are well known. This is not only necessary because the unitary measure, the assets, is wanting, but also because the amortization, the taxes and the like can not be completely brought into the accounts.

As opposed to the assets are to be considered the *debts or liabilities* (Passivkapitalien). They comprise all obligations which have arisen, whether from the acquisition of the assets or from the working of the farm. Debts covered by mortgages, the origin of which is no longer known, in so far as they affect portions of the agricultural assets, are treated at the beginning of the accounts as farming liabilities.

The most important division of the assets consists in setting apart what belongs to the farm. That the soil, with the water sources and rights connected with it, the improvements and the buildings, form part of the farm, there can be no doubt. But when the trees, and still more the field inventory, that is the value of the seeds and of the labour expended in sowing them, is considered, then the uncertainty begins. We recommend including in the farm capital account everything that is connected with the soil, including the trees, vines and field inventory, and to designate this as *farm capital* (Landgutskapital). The purchaser of a farm can always under every civil code claim that these objects be considered as an integral part of the property unless they be expressly excluded in the contract. Only when the plants are separated from the soil does the question arise as to whether they belong juridically to the soil or not. Whether these capitals are to be designated as farm capital or as ground capital does not matter. What is important is that they include the same elements. We prefer the expression farm capital (Landgutskapital) because it is more comprehensive than the much used ground capital and gives less occasion for confusion with bare soil capital.

This latter term should include all those parts of the assets which are not consumed by usage. They may, it is true, be destroyed (for instance ; land carried away by floods), but usually they are not liable to deterioration and they require no amortization. To this group belong the soil and the atmosphere over it, the springs and the rights pertaining to the soil. The soil capital represents the permanent and indestructible component of the farm capital and consequently differs from all other forms of capital.

That part of the assets which does not belong to the farm capital is grouped under the name of *farming capital* (Pächterkapital) and includes dead stock (Geräte und Maschinenkapital), live stock (Viehkapital), stores (Vorrätekapital), credits (Guthaben) and cash working reserves (bare Betriebreserven). These three last capitals form together the *circulating working capital* (umlaufendes Betriebskapital).

The two terms farm capital (Landgutskapital) and farming capital (Pächterkapital) are quite separate. How far each component of wealth belongs to the agricultural assets is shown by the definitions of agricultural capital and agriculture.

3. — *Gross returns* (Rohertrag). The results of agricultural work expressed in terms of quantity and value of the produced, improved or acquired products are called gross returns. This term means the final gross yield of the whole farm, or essentially the agricultural produce that has been sold or used by the household or by the accessory industries, and to which is added that produce which has gone to increase the original capital and the stores, and is thus included neither in the receipts nor in the produce supplied by the farm to the household and auxiliary industries.

However simple the calculation of gross returns may appear at first sight, it is attended by a series of difficulties. Of the *receipts* only those for farm produce sold are to be entered. *Credits* for the same are to be added at the end of the year. Receipts for credits belonging to previous years are to be excluded.

As *farm produce* not only the crops but all returns of the farm in the sense of the above definition are to be considered, consequently also the receipts from the accessory industries, rents for those parts of the capital that have been used by the farmer's family, etc.

The receipts from the sale of land, improvements, buildings, machines and implements do not belong to the gross returns.

Especial attention is required in the treatment of *purchased raw materials* and *animals*. The gross returns of live stock keeping would be erroneously represented if the animals sold, their produce delivered to the farmer and his family, as well as the increase of the live stock, were entered without deducting the value of the animals bought, since these were not produced by the farm. The same may be said of those agricultural products which are not transformed in the farm but are only sold again. Similarly fruit that is bought for the manufacture of wine or cider, milk bought for the dairy, potatoes for the distillery and so forth must be deducted from the gross returns. On the other hand fodders and manures purchased,

as well as seeds, are not to be deducted from the gross returns, as they are entered among the expenses. All purchased wares which have been deducted from the gross produce are naturally not be included in the expenses.

The comparison of gross returns will be improved by deducting from them the extraordinary expenses incurred for disposing of the produce, such, for instance, as the expenses for railway carriage of produce to be sold.

Among the items of gross returns the supplies in kind to the employees and labourers are included. Their value increases the labour bill by the same amount. If both were to be left out, the net returns would be equally correct, but both working expenses and gross returns would be too low in comparison with those farms in which wages are given in cash and not in kind.

If the stock of provisions produced by the farm has increased, the increase is entered as a component part of the gross returns. But how is the opposite case to be treated, that is when the stock of provisions has diminished? As a rule the decrease must be entered among the working expenses, that is to say not deducted from the gross returns. The case is to be considered like the purchase of provisions, especially fodder, manures and seeds; we do not subtract these from the gross returns, even when they are bought. Only when they are provisions destined to be sold is it more correct to deduct them from the gross returns. Their original amount was in fact contained in the gross returns of the preceding year as inventary at the end of the year's operation; being then sold in the course of the next year these provisions appear among the receipts again as gross returns. If they were not deducted the gross returns would be too high.

A part of the gross returns may also have been employed as *installation capital* (Anlagekapital) in the farm itself, for instance, timber for buildings. Supplies of goods for such objects are to be reckoned as components of the gross returns, and those used for the live stock capital, for the trees and other plants (in so far as they are installation capital) appear in the variations of stock in hand at the end of the year as compared with that at the beginning.

It is to be observed that for crops and animals only the *difference between amortisement and increase* is determined. To proceed with more precision, those individuals the values of which had increased and those the value of which had diminished should be treated separately and the increase of the former and the amortisation of the latter introduced into the accounts. The amortisation is to be included among the expenses. This more precise method is especially to be recommended for live stock keeping, but it renders special control of the live stock necessary, which is not customary in simple book-keeping. Consequently in general this distinction is not practised. For the draught animals, especially the horses, a special account is required, so that their amortisation does not appear in the increase of the total live stock, but always among the working expenses.

Increases in the value of the soil, buildings, improvements, machines and implements not owing their origin to supplies from the farm are not comprised in the gross returns. Consequently such increases of value due to purchases or to improvement of market conditions must not be included in the gross returns.

These considerations show that the definition of gross returns given at the beginning is not enough for practical work, but that it must be completed by further explanations. The following summary contains all the factors to be considered for an exact definition of gross returns.

Gross returns.

A. — *Receipts in cash from farm produce*, including the credits from the same source existing at the end of the year. (N. B. The credits existing at the beginning of a year of operation must be kept separate and do not enter into the account of receipts nor into that of credit at end of year).

a. — Receipts from plant products.
b. — " " animal products.
c. — " " accessory industries (dairying, etc.).
d. — " " letting of agricultural assets.
e. — " " interest of reserve agricultural capital.

B. — *Products of farm delivered to labourers paid in kind, to the household and to the family.*

a. — Plant products.
b. — Animal products.
c. — Products of accessory industries (dairying, etc.).
d. — Rents of farm assets used by the household or family.

C. — *Increase of the stock of farm products at the end of the year over that existing at the beginning of same year.*

D. — *Increase of the stock of animals, fruit trees, standing timber, vines and field inventory over that existing at the beginning of year.*

E. — *Supplies of farm products to the soil, improvement, building, machine and implement capital.*

From the above amounts the following are to be deducted in so far as they are contained in them:

1) *Expenses for purchase of live stock.*
2) " " " " *plants.*
3) " " " " *crude material* for the accessory industries (milk for the dairy, fruit, grapes, cider, must for wine making, potatoes for distilling, etc.).

4) *Expenses for purchase of agricultural produce destined to be sold again*, in so far as their value or the product of their sale is included in the gross returns.

5) *Extraordinary expenses for sale of produce* (railway carriage for milk and the like).

N. B. Similarly to these expenses, the debts for heads A to E are to be included at the end of the year, as well as all supplies from the accessory

industries to the household. Here also the debts from previous years are to be excluded.

4. — *Working expenses.* These represent the use and the outlay of money values required for the production of the gross produce, with the exception of the interest on capital. We designate the sum of working expenses plus the interest on capital as *Cost of production* (Produktionskosten).

The working expenses include the cash outlay and the corresponding debts at the end of the year for seeds, manures, feeding stuffs, wood and other items of stores which have been used or are devoted to obtaining the gross product, besides those delivered by the household and by the private accounts to the farm, and further the amortisations and the outlay on labour. In order to establish the working expenses, what has been said on the gross produce must be considered. Nothing that has already been excluded from the gross produce must be included here.

Only the outlay for working the farm is to be included in the working expenses. Consequently all outlay for the purchase of land, improvements, buildings, machines and implements, as well as investments of capital (Kapitalanlagen) current accounts, deposits in savings banks, purchase of shares and stocks, must be separated. As for the way of considering purchases of live stock and plant capital, it has been sufficiently discussed under the head of gross returns. The debts at the end of the year are included, while debts from previous years are to be deducted.

Personal supplies and those from the household are to be treated like the outlays or debts.

All those constituents of the installation capital which are not wholly included in the working expenses must be represented in these expenses by a quota of amortisation corresponding to their wear and tear. In order to calculate this, the principle must be maintained that their original value minus their final value must be as equally as possible distributed over the number of years that the object is likely to last.

The heading *labour expenses* includes not only the wages in cash, but also all those in kind, the board for farm servants in the household (participation in household expenses) and the wages of the farmer and his family. In fixing the amount of this last item the same salaries and wages must be calculated as would have to be paid to strangers, both for manual labour and for management. In large farms the upper limit for management is about 1 per cent. of the assets.

Expenses for the *interest on debts* and their *repayment* do not belong to working expenses. As for the rate of interest on the capital invested, it must be fixed independently of the working expenses. It is useful and interesting from several points of view to fix this rate. It may be done by adding to the interest on debts the interest of the net assets. But for comparisons it is better not to consider the debts, but to calculate the interest on the whole assets capital at a determined rate, namely that which the farmer would get on his money if deposited in a bank. If greater precision is desired, each group of capitals should bear a different rate of

interest accoding to the uninsurable risk to which it is exposed. But ti is sufficient to adopt a uniform rate of interest for the total asset capital.

Opinions differ as to the way of dealing with *rates and taxes* (Steuern u. öffentlichen Auflagen). Anyhow they cannot be reckoned as working expenses except to the extent that they are laid upon the capital of the farm and upon the income derived from it. A joint stock company will never doubt for a moment that taxes belong to its business expenses. Also other enterprizes managed by juridical persons consider taxes in this way. Why should it not be the same with enterprizes managed by private persons? We recommend therefore that all taxes connected with agriculture be reckoned with the working expenses, and in principle all prestations in kind also. But as in book-keeping by single entry they are not included in the gross returns they are omitted here, and the net returns are diminished by their amount. This question will be treated again when the net returns are discussed.

Summarizing then: Working expenses include the following factors:

1). *Outlay in cash for capital in stores* including debts at the end of the year. (N. B. The debts at the beginning of the year are to be left out and are not to be included either in the cash outlay or in the debts at the end of the year.)

2). *Outlay in cash for labour* for working the farm (farm hands, veterinary, etc.)

3). *Cash outlay* for taxes.

4). *Articles for working the farm* drawn from the stores-capital of the household and family.

5). *Outlay on labour.*

6). *Amortisation of installation capital.*

7). *Diminution of the stock of stores-capital* at the end of the year as compared with stock at beginning of year. From this is to be deducted:

The increase of the items of the stores-capital not included in the gross products (artificial manures, cakes, sulphate of copper, etc).

5. — The *net returns* (Reinertrag). Under this term is understood the difference: gross returns minus working expenses. This value represents the revenue from the whole of the assets (Aktivkapital).

It emerges from the above that it is not possible to give net returns a more concise definition or one answering better to the requirements of the practice of book-keeping. The most important thing is clearness and uniformity of principles in the calculation of gross returns and working expenses.

To what has already been said there is not much to add, but a few more words on taxes and burthens are necessary.

The net returns calculated according to our method represent the returns that remain to the farmer after having paid taxes and burthens. It serves to calculate the value of the land based on its returns, or capitalization value (Ertragswert des Bodens). If, for instance, a co-heir takes his share under the form of capital calculated according to the value of the returns,

he takes too little, because he exchanges a capital calculated as free from taxes against another one subject to them. But this difference is compensated by the fact that the rate of capitalization is frequently so low that the usual taxes on capital are already deducted. It must be noted also that farming is often burthened with considerable special taxes which capitalists do not know (obligatory labour, land tax without deduction of debts, etc.). The higher these burthens, the lower the price that the farmer pays for the land. Calculating the value of the returns without taking these burthens into account would be misleading. So long as it is a question of general taxes, the lower rates of interest offer sufficient compensation; for special taxes the deduction is justified. But to obtain the net returns of the farm free from burthens, the taxes must be added to the net returns. The best method is to designate this value as *tax-free net returns* (Steuerfreier Reinertrag).

6. — *Yield of the estate* (Vermögensrente). We call yield of the estate that part of the net returns which represents the interest borne by one's estate; it is found by subtracting the interest on the debts from the net returns.

7. — *Income* (Einkommen). Income can be defined as the money value that one may consume without diminishing his estate. It is thus found by adding to one's consumption the increase of the estate, or by subtracting from the consumption the diminution of the estate. In this income, however, accessory income may be included: this must be subtracted in order to find the *agricultural* income. This is found when the interests on debts are subtracted from the net returns, and the salaries and wages of the farmer and his family are added; or, what is the same, when the yield of the estate is added to the above salary and wages. The income can also be defined as the difference between gross returns and working expenses without the salary and wages of the farmer and his family, but with the interest on debts.

8. — The *compensation for labour* (Arbeitsverdienst). This term designates that part of the agricultural income which is left to the farmer as compensation for his work after he has calculated the customary local interest on the capital that he has put into the farm. The compensation of labour is thus found by subtracting from the agricultural income the amount of the interest on the estate without debts (Reinvermögen).

9. — The *components of the net returns* (Bestandteile des Reinertrages). When a certain amount is deducted from the net returns for interest on the farming capital, the returns of the farm itself (Landgutsrente) remain, and when from this the interests on the capitals representing crops, buildings and improvements are deducted, the ground rent (Grundrente) remains.

The farm returns thus represent the interest on the capital invested in the farm, and the ground rent the interest on the capital invested in the bare soil. The latter capital is distinguished by the fact that its sources, namely the soil and the air, are imperishable, and though it may vary it can never be permanently exhausted.

10. — *Value based on returns* or *capitalization value* (Ertragswert). The value of the farm based on returns can be calculated from the net returns. It means the amount of money which, in a perfectly safe investment at the usual local rate of interest, would yield the same sum as the returns of the farm. The sum which would yield the equivalent of the ground returns (Grundrente) is the value of the bare soil based on returns (Ertragswert des Bodens). The rate of interest chosen is based upon the interest borne by the safest State loans or by first mortgages.

It must, however, be considered that in the net returns all the expenses for management, taxes and insurance have already been deducted, so that the rate of interest must be correspondingly lower.

The value based on returns may also be calculated by capitalizing the whole net returns and then subtracting from it the amount of the farming capital and of the capitals in crops, buildings and improvements.

11. — *Difference of net returns* (Reinertragsdifferenz). If from the net returns, the sum which would be necessary to represent the interest of the estate (Aktivkapital) at the usual local rate be deducted, the difference of the net returns remains. This value may be positive or negative and it is important, especially for the calculation of the cost of production.

III. — Valuation

The question of valuation is more important for agricultural book-keeping by double entry, in which the net returns are decomposed into their elements, than for the present enquiry. The major part of the gross returns and of the working expenses, according to our definition, is composed of values for which the prices paid or received are stated. Anyhow a valuation must be made for the inventories at the commencement and at the end of the year. Nevertheless the enquiries of the Swiss Peasants' Secretariat have shown that on an average of the years 1908-11 the increases of inventory represent only 3.3 per cent. of the total gross returns; the diminutions of stores represent 2.5 per cent. of the total working expenses, while a further 5 per cent. of the expenses come from amortisation. These figures show clearly how slight is the influence of the estimation of the value of these changes upon the final result. But the valuation of the installation capital is also important inasmuch as the estate serves as a measure of the returns. According to the valuation of the farm, the same net returns seem high or low.

Agricultural book-keeping can give no information on the interest producing power of capital invested in agriculture, unless the principle be

observed of valuing the installation capital (Anlagekapital) at its cost price (Gestehungskosten), that is, entering the sum that would have to be spent in order to obtain the object considered. The quotas of amortisement with which former years of operation have been charged must be deducted.

Those provisions or stores destined for the consumption of the household or family must be entered at the price that would be realized free from all expenses (Reinerlös), or at the probable price at which they could be sold for being further worked up (Veredlungswert) (price minus sale costs and risks).

We must restrict ourselves to these two fundamental principles, as we cannot engage here in the details of the theory of valuation. Besides, the observance of these two principles is sufficient to render the results of book-keeping comparable.

IV. — The method of Book-keeping.

The number of manuals and methods of agricultural book-keeping is infinite. The attempt to give uniformity to all these systems is hopeless, and it would collide with the interests of many engaged in the publication of such works.

Fortunately, in order to make comparable statistics of agricultural book-keeping it is not necessary to follow only one system of book-keeping. Whether the single entry, or the double entry, or the American, Italian or German system be followed is immaterial, provided one condition be fulfilled, namely that all intercourse of the farm with the outer world be completely controlled and separated. By the outer world, not only the market and the usual customers are meant, but also the head of the enterprise, his family, household and accessory industries. Everything that the farmer draws or supplies must be noted and entered as if he were a customer who bought or sold on credit.

Consequently the following books are indispensable :

1. An *inventory*, in which the capital is entered and its variations are regisstered.

2. A *cash book* for registering the amounts of cash received or paid out.

3. A *housekeeping* or *farmer's book* for the registration of produce in kind delivered to or received from the household, private consumption or accessory industries of the farmer.

In what manner the entries into these books are to be made and whether they are to be supplemented by other books, the book-keeper is left free to decide (1). The only thing to insist upon is that all the entries be arranged in such a way that at the end of the year they may be distributed to the following accounts: *farm, common household, personal consumption and accessory industries*. In large estates where the family of the manager and the em-

(1) A comparative representation of the various systems of book-keeping adopted in farming will be found in my treatise : *Grundlagen und Methoden der Bewertung, Buchhaltung and Kalkulation in der Landwirtschaft*. P. Parey, Berlin, 1911.

ployees have separate households, that of the latter is connected directly with the farm and that of the former with the personal consumption account. The household account is then omitted. In peasant farms this account is necessary in order to distribute the housekeeping expenses according to the number of days that the various hands were present. It is also possible to close the accounts correctly for the farm alone without separating personal consumption from accessory industries; but to obtain the amount of total income and total consumption, the whole capital, the whole cash turnover and all exchanges in kind must be divided between the four accounts: farm, household, consumption and accessory industries. This system also renders the auditing of the books by the central book-keeping stations much easier. Detailed instruction on the way of keeping such an account is given in the writer's works (1).

V — Closing of Accounts.

The manner of closing the accounts depends partly on the system of book-keeping followed. As it is impossible to obtain uniformity in the systems of book-keeping, it is evident that the way of closing accounts must vary greatly. The legislation on taxes alone is enough to render uniformity in this respect impossible.

If it were enough to determine the net returns, the income and the values deriving from them, the final results of the most different books could be collected, provided that in calculating these values, the principles of the above definition had been observed. This, however, would not succeed in every case, as the legislation on taxes frequently renders variations necessary. For this reason, and still more because international book-keeping statistics are valuable especially on account of the comparison between gross returns and expenses, we recommend a special closing of accounts for the object of an international enquiry, to be adopted besides the usual closing for local purposes. Every book-keeping institution keeps its usual system of closing accounts, but with the help of its books makes another balance as a basis for scientific investigation.

This second closing of accounts would consider its chief task to consist in the resolution of gross returns and expenses into their elements. For this purpose the items of the inventory of the cash book and of the housekeeping book should be distributed in as many groups as there are divisions in the gross returns on one hand and in the expenses on the other. Each division is an account with Dr. and Cr. which may be kept according to the German or Italian method, but not the American, because the number of accounts

(1) Laur, *Grundlagen und Methoden der Bewertung, Buchhaltung und Kalkulation in der Landwirtschaft.*

Laur, *Landwirtschaftliche Buchhaltung für bäuerliche Verhältnisse.* 5th Edit. Aarau, 1913.

Laur, *Comptabilité agricole de la petite et moyenne culture.* Published by the Union suisse des Paysans, 2nd Edit. Brugg, 1913.

is too large. Still simpler is the following system, which resembles the American system, but in reality has nothing to do with it; it is rather German book-keeping in which a line is given to every account. The texts of the individual entries which are usually written under each other in the account are here in the heading of the table. This leads to the double advantage of not having to write the text and of being able to condense the whole closing of the account in a few pages.

The system is described in my work: *Grundlagen und Methoden der Bewertung, Buchhaltung und Kalkulation in der Wirtschaft,* (Berlin 1911) at page 355. Here an instance is shown in the tables at the end of this paper.

VI. Elaboration of Results

In order to compare the results of book-keeping with each other, they must first be reduced to a common measure. We describe below the method applicable to those values which it would be especially desirable to render comparable and to publish in a uniform manner.

a) *Net returns.* — This important value is given per hectare (2.47 acres) of cultivated area and in percentages of the capital.

b) *Agricultural income.* — As general measure only the extent is to be considered. For peasant conditions the number of days' work of the farmer's family, reduced to days' work of an adult, is a preferable measure.

c) *Returns of whole estate.* — This is compared to the net estate invested.

d) *Compensation of labour.* — This value is utilizable only for peasant conditions. It is measured by the number of days' work of the farmer's family.

e) *Value of the farm based on returns.* — Besides the area, the gross returns are especially suitable as a measure. The ratio between value based on returns and the gross return, or the factor of the capitalization value, is of especial importance for the valuation on the basis of returns.

f) *Gross returns.* — It is not enough to calculate the total sum of gross returns per unit of area; the composition of the gross returns must also be analysed as is shown by the example given. The individual sub-groups can also be reduced per unit of area, but it is especially important to calculate the percentage composition of the gross returns.

g) *Working expenses.* — The same may be said for this item as for the gross returns. It should be expressed in its totality and in its constituent parts, per hectare and according to percentages.

h) *Difference of net returns, or the farmer's profit.* — This value is compared with the gross returns. The figure shows by how much per cent. the average prices obtained must be increased or lowered in order that the gross returns thus calculated should cover the whole of the expenses, including the compensation for the farmer's family and the interest demanded by the capital. The price modified by this factor thus represents the *cost of production.*

Example :

Capital 100 000 frs. at 4 per cent. =	4 000 frs. interest
Net returns	3 500 »
Difference of net returns, or farmer's profit or loss	500 »
Gross returns.	10 000 »
Difference of net returns in percentage of gross returns	5 per cent.
Average price realized for milk . . .	20 centimes per kg.

Consequently cost of production :

$$20 + \frac{5 \times 0.20}{100} = 20 + 1 = 21 \text{ centimes.}$$

i) *Capital.* — The capital must be shown in its totality and arranged according to its chief component parts (soil, improvements, buildings, forest trees, fruit trees, vines, field inventory or cultivation and manure in fields, live stock, machines and implements, stores and cash) and reduced to the unit of area and to percentages of the whole capital.

j) *Various values.* — Besides the above values a whole series of others can be calculated ; thus for instance the household expenses for the day's keep of an adult, the cost of the day's work per grown-up member of the farmer's family or per hired labourer, the value per hectare of the bare soil according to returns, etc. We refer the reader to the reports of the Swiss Peasants' Secretariat (1).

k) *Grouping of the relative data.* — It is desirable that the data should also be divided according to the sizes of the farms, according to the system of farming and according to the general trend of the farms. As for size we recommend the following groups :

Farms	under	3		hectares	(7.4 ac.)
»	between	3	and	5	(7.4-12.35 ac.)
»	»	5	»	10	(12.35-24.7 ac.)
»	»	10	»	15	(24.7-37 ac.)
»	»	15	»	30	(37-74 ac.)
»	»	30	»	70	(74-173 ac.)
»	»	70	»	200	(173-494 ac.)
»	»	200	»	500	(494-1235 ac.)
»	»	500	»	1000	(1235-2470 ac.)
»	above	1000			

As for the systems of farming, no general rules can be given, as conditions vary greatly. The following however may be given as examples :

(1) Untersuchungen betreffend die Rentabilität der schweizerischen Landwirtschaft. — *Landwirtschaftliches Jahrbuch der Schweiz*, 1913.

1. Grazing farms.
2. Three-course rotation with fallow.
3. Improved three-course rotation.
4. Four-couse rotation.
5. Clover and grass leys with alternate cereal crops (Kleegras und Koppel-wirtschaften).
6. Grass farms.
7. Farms with limited live stock.

As for the general trend of the farm, the following may be mentioned:

1. Cattle breeding farms.
2. Cattle fattening farms.
3. Milk farms.
4. Combined animal husbandry farms.
5. Cereal farms.
6. Mixed crops without sugar-beets or potatoes for distillation.
7. Mixed crops with sugar-beets or potatoes for distillation.
8. Sheep farms.
9. Market garden farms.

Here also conditions vary to such an extent that only the main lines can be set down. For the distribution into groups, the chief character is the composition of the gross returns.

VII. Aims to be Attained.

At first it can only be the question of bringing more uniformity into the scientific enquiries on book-keeping, by awakening interest in the subject and by teaching, and this is the object of the present paper. Then the International Institute of Agriculture in Rome could collect all the publications of agricultural book-keeping institutions and point out to the heads of such institutions the advantages of uniform notions and methods.

As final goal, the systematic elaboration of all these results with a view to scientific and practical results should be contemplated. The International Institute in Rome might thus become the central book-keeping office of all civilized peoples. Such an office would not only further the science of economics, but would also render the most valuable service in pointing out the best measures to be adopted for practical farming, in the choice of produce for the market, in determining prices and in agricultural policy in general.

SECOND PART.

ABSTRACTS

AGRICULTURAL INTELLIGENCE

GENERAL INFORMATION.

DEVELOPMENT OF AGRICULTURE IN DIFFERENT COUNTRIES.

90 — **Agriculture in New Servia.** — ADAMOVIC, L. in *Österreichische Monatsschrift für den Orient*, Year XXXIX, No. 11, pp. 197-198. Vienna, November 1913.

The extension and importance of the cultivation of the chief crops in the territory recently acquired by Servia: vines, tobacco, melons, cereals, pulse, potatoes, beets, vegetables, hemp and flax; mulberry plantations for silkworm rearing, poppy growing for opium manufacture, sesame cultivation, chestnut plantations. The chief feature as regards live stock is the large number of buffaloes kept. Bee-keeping is widespread.

91 — **Agriculture in Uele (Belgian Congo).** — GOFFINET, J. in *Bulletin agricole du Congo belge*, Vol. IV, No. 3, pp. 587-609 + 1 map and 27 figs. Brussels, September 1913.

The old district of Uele consists of the basin of the river bearing the same name and of its numerous tributaries as well as that of the river Bomu with its tributary the Bili, and the basins of the Likati and Rubi rivers.

In its south-western part the agricultural district of Uele is decidedly equatorial while to the north-east its character is subtropical. The division between these two belts is marked by the rivers Bomokandi, Uele and Bili.

The swamps are relatively of small extent, so that mosquitoes are less numerous than in most of the rest of the colony.

The natives, who are considered the strongest of the colony, are very numerous. They are peaceful and frequently well organized; they cultivate the land and are hunters or fishermen. Labour is abundant and easily recruited.

Crops. — Bananas, manioc, maize, sweet potatoes, ground nuts, mountain rice, and sugarcane are the most widely spread crops in the forest region (equatorial belt), whilst on the savannahs, wire grass, sorghum, sesame and haricots, with maize, manioc and sweet potatoes, are more cultivated.

The only system of fertilizing practised is by fallowing, which allows the forest or the grasses of the bush to grow again and enrich the soil with their detritus.

With the exception of palm and sesame oils, which are objects of trade among peoples sometimes distant from each other, agricultural produce is consumed on the spot or not far off.

Live stock breeding. — Cattle is raised only in the eastern extremity of the Uele towards the summits which mark the watershed between the Congo and the Nile.

Prices of domestic animals.

Cattle	8*s* to £ 2
Horses	about £ 40
Asses	£ 6 to 16
Mules	£ 12 to 28
Sheep	4*s* to £ 1
Fowls	up to 10*d* and 1*s* 8*d*.

The domestication of elephants gives very satisfactory results at Api.

92 – **Recent Research on the Causes of Pellagra and New Views on its Cure.** — 1. ALESSANDRINI, GIULIO. Sulla pellagra in Italia. Osservazioni epidemiologiche. — (Reprinted from *Annali d'Igiene Sperimentale*, Vol. XX, New Series, Part IV), pp. 49, Turin, 1910. — 2. ID. and SCALA, A. Contributo nuovo alla etiologia e patogenesi della pellagra. (Reprinted from *Il Policlinico*, Sezione pratica, Year 1913) pp. 24. Rome, 1913. — 3. Pellagra triste.... Nuovi studi sulle cause e nuovi orientamenti per la cura. — *La nuova Agricoltura del Lazio*, Year I, No. 14, pp. 109-111. Rome, July 16, 1913. RUR HYGIEN

Pellagra in Italy. — The Italian provinces infected by pellagra number 23; the deaths due to this disease are estimated at 4000 per annum, while several hundreds of pellagrins are admitted every year to the asylums for the insane. According to the official census, the number of persons suffering from pellagra was 33 869 in 1910, as against 104 067 in 1881. In Latium pellagra exists to a very limited extent: according to a subcommittee of the provincial committee for the study of pellagra, there were in the first half of 1913, 46 cases (including doubtful ones), distributed in 12 communes. But whilst in Italy on the whole the disease is gradually decreasing, in Latium pellagra has always been stationary, both in the number of patients and in the localities in which the disease appeared.

Connection between pellagra and agriculture. Theories on the etiology of pellagra. — According to the most generally accepted opinion, the disease is especially rife among rural populations, and some believe that it attacks cattle and other domestic animals.

Pellagra has been attributed in turn to the following specific causes:

1. The use of damaged maize as food (the maize theory of Lombroso and his school); on this has been based, in Italy, the prevention and cure of the disease and the legislation concerning it (Law of July 21, 1912, on the prevention and cure of pellagra).

2. A special infection caused by a germ (*Streptobacillus pellagrae*), which is believed to develop on spoiled maize (theory of Professor Guido Tizzoni).

3. Inoculations by special Diptera (sandflies), of the family Simulidae, allied to mosquitoes and living in running waters (Dr. Sambon's theory).

4. *Drinking the water of certain localities* (Alessandrini and Scala's Theory). This theory has been corroborated by experiments carried out by Professors Alessandrini and Scala at the Institute of Hygiene at the University of Rome, under the auspices of Prof. Celli, Director of the Institute.

The Alessandrini-Scala theory. — The researches conducted by Alessandrini since 1909 lead to the conclusion that pellagra is a *sharply localized* disease and that it is contracted in those determined districts in which the water usually drunk springs from clay soils or flows and stagnates upon them. He supposed at first that the specific cause was some parasite living in such waters and belonging to the Filaria group. But the first experiments made according to this hypothesis, caused it to be rejected, but at the same time confirmed that the disease was due to the water. Prof. Scala then supposed the pathological agent contained in the water to be of mineral origin, and numerous experiments carried out on rabbits, guinea-pigs, dogs and monkeys confirmed the writers in their opinion that pellagra is the effect of a chronic poisoning due to silica in colloidal solution in waters of a certain composition.

" Clay, which is a silicate of alumina, is the original cause of the disease, as rainwater acting upon it causes a hydrolysis, from which both silicic acid and hydrate of alumina, according to the conditions under which hydrolysis takes place, may pass into the water in colloidal form. However, as there is incompatibility between colloidal silica and aluminia and they precipitate each other, there remains in the water only the excess of silica over that quantity required to precipitate the alumina; part of the colloidal compound silica-alumina, which is not to be confused with silicate of alumina, deposits, while the rest remains in extremely fine colloidal suspension, causing that persistent opalescence frequently observed in the water drunk by pellagrins. On entering the human organism, the silica causes a retention of sodium chloride, which, in contact with the protein of the tissues, gives rise to the formation of hydrochloric acid, and consequently to a true poisoning by a mineral acid ".

Not all waters containing silica cause pellagra, because, as is well known, *colloidal silica* may be influenced by some neutral salts or mixtures of these present in the water, which may prevent, alter, or in some cases increase, the injurious effects of silica. By means of numerous experiments, the writers found that the salts which act beneficially are the alkaline carbonates in general and especially that of lime, which exists or may exist in drinking water.

New prevention and cure of pellagra. — As pellagra is the consequence of an excess of mineral acid in the system, the cure can only consist in its neutralization by means of an alcaline solution. The writers used solutions

of trisodium citrate on diseased persons and animals; this treatment rapidly proved beneficial. Admitting that colloidal silica may readily be rendered harmless by carbonate of lime, the prevention of pellagra consists simply in having an excess of carbonate of lime, as small pebbles, always present in the waters causing the disease.

At the same time the necessity of continuing the campaign against the use of damaged maize and its products does not cease, because this food is always one of the chief predisposing causes.

The Roman committee on pellagra has resolved to experiment on a large scale the new method of prevention and cure in some of the most important centres of pellagra in Latium.

EDUCATION AND EXPERIMENTATION IN AGRICULTURE AND FORESTRY.

93 – **The Imperial Japanese Tohoku University at Sapporo (Island of Yesso).** — MÜLLER, MAX in *Deutsche Landwirtschaftliche Presse*, Year XXXX, No. 88, pp. 1047-1049; No. 89, pp. 1060-1062. Berlin, November 1 and 5, 1913.

The Agricultural College at Sapporo, which was founded in 1876, was declared on September 1, 1907, to be a branch of the Sendai University. It comprises four separate three-year courses for agriculture, agricultural chemistry, forestry and animal husbandry. Schools of fishery, civil engineering, practical agriculture and practical forestry are attached to the institution, as well as a so-called preparatory school, in which students are prepared by a three- years' course of studies for the University. It possesses two university farms, 185 and 272 acres in extent, of which one is devoted to the experiments and practical work of the students, and the other is a model farm. Besides the above, the institution has also a botanical garden of about 27 acres in extent and can avail itself of 127 244 acres of forest.

In the University itself there are 23 professors and 25 assistant professors, and in the schools attached to it about 50 lecturers. The total number of students last year was 898, *viz.* 211 at the University, 297 at the preparatory school and 390 at the other schools. As university students only the young men possessing the leaving certificate of the preparatory schools are admitted. For admittance to the preparatory and other schools the leaving certificate of a five-years' medium school is required.

The writer describes the situation of the various school buildings, and discusses the three-years' curriculum of the preparatory and of the practical agricultural school, the six to eight-years' curriculum of the elementary schools and the five-years' one of the medium schools. He concludes with some interesting data on Japanese student life.

94 – **The Rural Travelling Houseekeeping Schools in Prussia in 1912.** — *Zeitschrift für das Ländliche Fortbildungsschulwesen in Preussen*, Year 5, Part 2, pp. 47-61. Berlin, November 1913.

In 1912 there were in Prussia 250 rural travelling housekeeping schools in full working order, divided amongst 243 Districts ("Landkreise"). The numbers in the various provinces were as follows: East Prussia 11, West Prussia 3, Brandenburg 21, Pomerania 17, Posen 34, Silesia 37, Saxony 13, Schleswig-Holstein and the Hohenzollern territory 1 each, Hanover 28, Westphalia 12, Hesse-Nassau 21, the Rhine Province 51.

A total of 817 courses were held as against 564 in the previous year. The number of the eight-weeks' courses has risen from 407 to 638, and that of the longer from 67 to 103, while the courses of less than eight weeks' duration have fallen from 90 to 76. The 817 courses were attended by 13 581 girls and young women who had left school, an average of 21.3 per course. More than half of these (53 per cent.) came from the peasant classes, 20 per cent. were the daughters of country tradesmen, while 15 per cent. of the scholars belonged to the agricultural labourers' class and 12 per cent. to the professional and similar classes.

Of the 250 schools, 168 were supported by the District Communal Associations, 5 of them being under the management of Womens' Unions, 65 schools were entirely managed by Womens' Unions and 17 by private individuals and others. The whole maintenance cost amounted to £29 304, of which £11 027 was contributed by scholars' fees and nearly half the remainder by the Districts.

AGRICULTURAL SHOWS AND CONGRESSES.

95 – Agricultural Shows.

Belgium.

1914. March. Brussels. — Exhibition of agriculture and agricultural machines and implements.

Denmark.

1914. March 30-31. Copenhagen, Grundtvigs Hus. — Seventeenth dairy show, organized by the Seeland-Laaland-Falster Agricultural Society and the Danish Dairy Society.

France.

1914. March. Carcassonne (Aude). — Competition for vine-mildew fungicides, arranged by the "Société centrale d'agriculture de l'Aude". Offices: rue et hôtel Courtjaire, Carcassonne.

March 15-30. Grasse (Alpes-Maritimes). — Agricultural, horticultural and industrial exhibition. Includes the following classes: 1) Perfumery; 2) Olive oil, other olive products, apparatus and accessories for preparation of olive oil; 3) Horticultural produce and materials; 4) Produce of other branches of agriculture and materials.

May 20-27. Paris, Cours la Reine. — Spring horticultural show held by the "Societé Nationale d'Horticulture de France".

May 21-24. Angers, Place de la Rochefoucault. — Second triennial show held by the Maine-Anjou Cattle Breeders' Society. Sec: M. Delhommeau, Avenue Carnot, Château Gontier, Mayenne.

May 29-June 2. Lyons. — International Poultry Show, in connection with the Urban Show. A Poultry Congress will also be held. Address: 3 Place des Cordeliers, Lyon.

Germany.

1914. June 9-Sept. 6. Minden (Westphalia). — Agricultural and horticultural show annexed to the Arts and Industries Exhibition.

Russia.

1915. St. Petersburg. — Great international exhibition of the cheese industry, including all forms of utilization of milk.

United Kingdom.

1914. April 14-17. Dublin, Ball's Bridge. — Spring show of the Royal Dublin Society. Address: Agricultural Superintendent, Leinster House, Dublin.

Oct. 20-23. London, Royal Agricultural Hall. — Dairy show. Sec: F. E. Hardcastle, 28 Russell Square, London, W. C.

Oct. 31-Nov. 6. London, Royal Agricultural Hall. — Brewers' show.
Nov. 28-30 — Dec. 1-3, Birmingham, Bingley Hall. — Cattle and Poultry Show.
Sec.: W. H. Lythall, Bingley Hall, Birmingham.

96 – **Agricultural Congresses.**

France.

1914. May 22. Paris. — Horticultural Congress, organized by the "Société Nationale d'Horticulture", 84 rue de Grenelle, Paris.

CROPS AND CULTIVATION.

97 – **Temperature Coefficients in Plant Geography and Climatology.** — LIVINGSTON, B. E. and LIVINGSTON, G. J. in *The Botanical Gazette*, Vol. LVI, No. 5, pp. 349–375 + 3 figs. Chicago, November 1913. AGRICULTURAL METEOROLOGY.

This paper deals with the methods of interpreting climatic temperature data for phytogeographical purposes. Temperature and its influence on plant growth vary only with respect to intensity and duration. As the controlling climatic conditions are only effective during the season of active growth, the duration factor is estimated as the time between the last killing frost of spring and the first frost of autumn. The temperature efficiences for growth corresponding to the normal daily temperature means are deduced from the assumption that physiological processes conform to the Van't Hoff-Arhenius principle and that the rate of growth has a temperature coefficient of 2 for each 10° C. of variation within the ordinary limits of environmental temperatures. Thus, if the rate of growth is unity at 40° F. and it doubles for each rise of 10° C. (or 18° F.) above this, and if t rep esents the normal daily mean temperature (F) then μ, the corresponding temperature efficiency index, is given by the formula —

$$\mu = 2\,\frac{t-40}{18}$$

The summations of the normal daily mean temperature and of the daily temperature efficiencies of various stations throughout the United States were indicated on charts. The positions of the isoclimatic lines thus obtained show a marked similarity. Therefore, for most of the area of the United States the two methods of estimating temperature effectiveness for plant growth give results which agree within the limits of 5 per cent. This similarity, however, is only superficial and roughly approximate, since the ratios of the two are not constant, but range in magnitude from 7.49 to 10.44.

The ratios between these two series of indices were indicated on another map and the positions of their isoclimatic lines suggest that these ratios are a measure of some as yet unknown climatic characteristic.

SOIL PHYSICS, CHEMISTRY AND MICROBIOLOGY.

98 — **Effect of the Nature and of the Water Content of Soils upon their Nitrogen Content** (Mitteilung aus der agrikultur chem. Versuchsstation in Halle a. S.). — MÜNTER, F. (author of Report) and ROBSON, W. P. in *Centralblatt für Bakteriologie*, etc. II Abt., Vol. 39, Nos. 15-17, pp. 419-440. Jena, November 29, 1913.

The writers set themselves the following problems :

1. How do organic nitrogenous manures behave in different soils with various water content ?

2. How does sulphate of ammonia behave in similar conditions ?

3. Under what conditions and in how much time does the optimum formation of nitrates take place ?

4. At what degree of humidity do losses of nitrogen occur ?

5. What is the action of organic sources of carbon upon the nitrogen content when nitrate and sulphate of ammonia are added ?

With the object of answering the above questions, they conducted culture experiments in pots in the laboratory and with applications of nitrogenous manures at the rate of upwards of 2 tons per acre, that is in quantities not practically applicable. The experiments were carried out on three kinds of soil containing the following quantities of nitrogen :

Soil	Nitrogen			
	nitric	soluble ammoniacal	total ammoniacal	total
	per cent.	per cent.	per cent.	per cent.
Sandy	0.00103	—	0.00057	0.09148
Loamy	0.00654	—	0.00119	0.15977
Clayey	0.00152	—	0.00044	0.17223

The degrees of moisture experimented with were respectively 6, 12 and 18 per cent. for the sandy soil ; 8, 16 and 24 for the loam; 8, 18 and 28 for the clay. The determinations were made after three, six and twelve weeks.

It appears that organic compounds of nitrogen decompose more intensely in sandy soils than in loams or clays when the degree of moisture is low ; if this increases the difference tends to diminish. On the contrary the transformation of sulphate of ammonia into nitrates takes place all the more rapidly the higher the water content in sandy soils as well as in loams and clays; there is, however, a difference in the fact that in loam and clay the biochemical activity is greater, while with the lower degrees of moisture the transformations in sandy soils begin with more energy. It appears consequently that 6 per cent. of moisture in sandy soil is more favourable to bacterial activity than the 8 per cent. of clay soil.

The ammoniacal nitrogen which is formed from horn meal disappears rapidly in the presence of much moisture in the various soils ; on the contrary with a low degree of moisture it keeps longer, and the maximum is sooner reached the lighter the soil. Thus in sandy soils after three weeks it was 36.68

per cent., in loam after six weeks it was 41.28 per cent. and in clay after twelve weeks only 13.37 per cent. of the nitrogen that was applied. The absorption of ammoniacal salts is greater the heavier the soil. This must be especially noticeable in dry years. After 12 weeks the sandy soil can transform 97 per cent. of the sulphate of ammonia added to it, while loams and clays can transform up to 100 per cent., which however is not all found under the nitric form. With horn meal the formation of nitrates proceeded most favourably in sandy soils; only with medium water content did the better soils show similar conditions. The greatest quantities of nitrates are produced in all soils by sulphate of ammonia, with the exception of dry sandy soil and, in the case of much moisture, during the first weeks.

In general the most intense formation of nitrates with the various soils occurs between the third and the sixth week after the manure has been given; only in the clay soil with the greatest moisture the maximum intensity of transformation appeared during the first three weeks. At the time of the greatest content of nitrate, that is after six weeks with medium moisture, the following were the proportions of easily assimilable nitrogen in percentages of the nitrogen applied:

Manure	Sandy soil		Loam		Clay soil	
	nitric N.	ammoniacal N.	nitric N.	ammoniacal N.	nitric N.	ammoniacal N.
Sulphate of ammonia	60.07	28.51	78.83	6.67	78.17	5.48
Horn meal	49.15	0.00	58.71	0.69	57.24	0.00

Thus, by giving mineral nitrogen fertilizers the plants have greater quantities of plant food at their disposal than when organic manures are given.

A considerable quantity of nitrogen was freed only with the highest water content, with sulphate of ammonia in loamy soil to the extent of 19.8 per cent. of the added ammoniacal nitrogen at the end of the experiment, and with horn meal 32.2 per cent. in loam and 32.7 per cent. in clay.

A very heavy addition of organic matter under the form of sugar reduced the soluble nitrogen compounds to such an extent as to cause a lack of nitrogen for the plants. Thus the ammoniacal nitrogen added to the three soils disappears more rapidly in the presence of sugar, but without a corresponding increase of nitrate, the nitrogen that disappears being taken up by the bacteria.

By the addition of sugar to the ammoniacal manure, with medium moisture and after six weeks, the content of nitric nitrogen diminished in the sandy soil from 57.52 to 50.87 per cent., in the loam from 58.10 to 52.97 per cent. and in the clay soil from 70.92 to 61.62 per cent. Consequently the nitrogen that was fixed and subsequently removed on the addition of sugar increased in the sandy soil from 18.18 to 26.18 per cent., in the loam from 22.32 to 43.20 and in the clay from 29.08 to 38.38 per cent.

The formation of proteids was also increased by the addition of organic matter, and the loss of free nitrogen in the sandy soil was 11.43 and in the loam 14.67 per cent. of the nitrogen applied, while no loss was observed in the clay soil.

Lastly no fixation of free nitrogen could be proved.

99 — **The Displacement of Potash in Felspar by Certain Substances Employed as Fertilizers.** — *Comptes Rendus des Séances de l'Académie des Sciences*, Vol. 157, No. 19, pp. 856-858. Paris, November 10, 1913.

The writer has resumed his investigations into the double decomposition which occurs when felspar rock is triturated in contact with solutions of certain substances. For this purpose a microcline of Utöe of the following composition was used:

silica	66.03 per cent.
alumina	19.12 » »
potash	11.38 »
soda	2.96 » »
lime	0.22 »
ferric oxide . . .	traces
magnesia	»

This was ground and passed through a sieve with 70 holes to the square inch. Ten to twenty gms. were put into a mortar and subjected to mechanical trituration for 130 hours in the presence of 100 cc. of water to which certain substances had been added. The liquid was then filtered through a collodion filter and analysed, with the results given in the accompanying table. It should be noted that besides the action of the added substances the felspar is subjected to the action of water and atmospheric carbon dioxide in every case:

Amount of felspar employed: gms.	Added substance	Potash dissolved		
		gms.	per cent. of the felspar	per cent. of the potash in the felspar
10	—	0.0112	0.112	0.98
10	—	0.0139	0.139	1.22
20	1 gm. sodium chloride	0.0741	0.37	3.25
15	» calcium carbonate	0.0407	0.27	2.38
15	» tricalcic phosphate	0.0336	0.22	1.96
15	» monocalcic »	0.0667	0.44	3.90
15	» sodium nitrate	0.0548	0.36	3.21
15	» ammonium sulphate	0.1260	0.84	7.38
15	» calcium »	0.0552	0.36	3.23

Clearly the added substances have in every case caused the displacement of a larger quantity of potash than was given up to the pure water.

Now substances dissolved in the soil water are derived from the reaction of water, more or less charged with carbon dioxide, on the rock particles of the soil itself, the ease with which the particles are attacked increasing as their size diminishes. But this solvent power of water is further increased by the presence of other substances in solution, some of which, such as lime and gypsum, are normally present in soils, while others are added as fertilizers. Therefore the formation of the so-called " soil solutions " may be attributed to contact actions similar to the ones discussed above, where the intimacy of the contact was greatly accentuated owing to the experimental conditions.

With regard to individual results : soda, in the form of both nitrate and chloride, has a very distinct action and displaces an almost identical quantity of potash in both cases. It should be noted further that the less soluble salts, such as lime and tricalcic phosphate, whose solubility increases with the carbon dioxide tension of the soil atmosphere, displace very perceptible quantities of potash. Calcium sulphate and the very soluble monocalcic phosphate react more strongly, but the effect of the latter is limited by retrogressive phenomena. Ammonium sulphate is the most active salt of all, as has already been noted by previous observers.

In conclusion, double decomposition plays an important part in the formation of nutritive soil solutions when the mineral elements in the soil and the added fertilizing material are reduced to a sufficiently fine condition for them to react easily on one another.

100 – **Studies es on Acid Soils of Porto Rico.** – Loew, O. – *Porto Rico Agricultural Experiment Station, Bulletin* No. 13, pp. 23. Washington, October 1913.

An examination of certain clay soils in Porto Rico which owe their acidity to the nature of the clay rather than to the presence of organic acids. The soils were subjected to both chemical and bacteriological tests, and the effect of lime was also investigated in some cases.

101 – **Bright Virginia Tobacco Soils.** — Blackshaw, G. N. in *The Rhodesia Agricultural Journal*, Vol. XI, No. 2, pp. 209-212. Salisbury, Rhodesia, December 1913.

A comparison of the mechanical analyses of typical tobacco soils from Virginia and North Carolina with those in Rhodesia, showing that the latter are lighter in character, whether derived from granite or from sandstone.

102 – **Sprinkling the Ground in Farming and Gardening.** — Strecker, in *Deutsche Landwirtschaftiche Presse*, Year 40, No. 85, p. 1013. Berlin, October 22, 1913.

The writer describes some models of his sprinkling system. These were exhibited at the International Building Construction Exhibition at Leipzig in 1913 and are protected by patents. After dealing with their importance, the writer gives a description and illustrations of the different systems, which are simple, practical and inexpensive.

MANURES AND MANURING

103 – **The Influence of Manuring upon the Composition of Soils and their Suitableness for Certain Crops.** (Mitt. aus dem Institut für Boden-und Pflanzenbaulehre der Kgl. landw. Akademie zu Bonn-Poppelsdorf). — MAUSBERG, A. in *Landwirtschaftliche Jahrbücher*, Vol. XLV, Part 1, pp. 29-101. Berlin, 1913.

On the basis of the continuous manuring experiments commenced in 1895 in the experimental field of the Bonn-Poppelsdorf Agricultural Academy, the writer makes some remarks on the connection between manuring and the conditions and fertility of the soil. The observations refer to a five-year's rotation (1907-11) on a loam soil, physically well constituted, but but relatively poor in plant food; the manure given varied on the fourteen plots from a complete manure (nitrate of soda 2.4 cwt., kainit 6.4 cwt., double superphosphate, containing 40 per cent. P_2O_5 1.6 cwt., quicklime 7.8 cwt., calcinated magnesia 3.2 cwt. per acre per annum) to none at all. Thus the plots were: 1) unmanured, 2) with nitrate of soda, 3) with sulphate of ammonia, 4) with potash, 5) with phosphoric acid, 6) with lime, 7) with magnesia, 8) with complete manure, 9) do. without nitrogen, 10) do. with sulphate of ammonia, 11) do. without potash, 12) do. without phosphoric acid, 13) do. without lime, 14) do. with mixed manures, that is farmyard manure with phosphoric acid and potash; in some cases nitrogen was given under the form of dried blood.

The connection between the crops, the conditions of the soil and the manures are summarized in Table I.

TABLE I.

Crop in rotation	Effect observed					Superiority of nitrogenous manure	Treatment which yielded the maximum crop.
	of nitrogen	of potash	of phosphoric acid	of the reaction of the soil	of the favourable structure of the soil		
Winter rye	slight	marked	slight	generally nil	uncertain	nitrate of soda, slight	complete or mixed manure
Oats	strong	strong	marked	do.	generally nil.	nitrate of soda, marked	complete manure, alone
Peas	—	strong	slight	marked	do.	—	only with contemporaneous application of potash and lime
Potatoes	marked	very strong	slight	generally nil.	do.	sulphate of ammonia, marked, especially for quality	mixed manure
Sugar beets	strong	strong	slight	strong	strong	nitrate of soda, marked	complete manure, easily assimilable nitrogen with sufficient potash with high alkalinity and favourable structure of soil.

Conclusions.

1. *Winter rye* proved very thrifty from every point of view; abundant manuring gives very low profits; loose soils are more favourable than compact ones; the soil reaction has no effect upon rye.

2. *Oats* require especially easily assimilable nitrogen (nitrate of soda); after nitrogen, the development depends to a remarkable extent upon a sufficient supply of potash; there are no observations on the connection between yield and looseness and reaction of the soil.

3. *Peas:* good crops are obtained only by the contemporaneous use of potash and lime; deficiency of either causes the same diminution of crop as the want of both.

4. *Potatoes:* the character of typical potash plants is confirmed, as of all the fertilizing elements potash acts with the greatest energy on the increase of the crop, and as soon as it is lacking the yield falls off, even if the other elements be present in abundance. Sulphate of ammonia behaves better than nitrate of soda. The reaction of the soil exerts no action; consequently when the other elements are present, especially magnesia, the lack of lime does not cause any decrease of crop; the heaviest crops have been obtained by 8 tons per acre of stable manure assisted by phosphatic and potash manures, notwithstanding an insufficient alkalinity of the plot.

5. *Sugar beets* feel the want of any one or two of the following conditions:

a) easily assimilable nitrogen,
b) sufficient potash,
c) increased alkalinity and favourable texture of the soil.

Beets differ from potatoes in many points: thus, though they require potash manures, they feel the lack of them less than do potatoes; beets also react markedly to lack of lime, even when supplied with magnesia; and whilst potatoes prefer sulphate of ammonia, beets prefer nitrate of soda; further, manures injure the starch content of potatoes more than the sugar content of beets, and while the use of potash salts deteriorates the quality of potatoes, it improves that of beets; lastly, for both these crops phosphoric acid produces only an insignificant increase of yield, whilst sulphate of ammonia exerts a favourable influence on the formation of carbohydrates.

104 – **Results obtained at the Tjikeumeuh Experiment Garden with various Green Manures.** — Van Helten, W. M. in *Mededeelingen uit den Cultuurtuin*, No. 1, 17 pages + 9 plates. Buitenzorg, 1913.

The plants with which experiments were made at Tijkeumeuh (Buitenzorg) were divided into four groups according to the most suitable manner of utilizing each kind.

I. — *Green manure plants sown between the rows of the main crop, and the leaves of which may be cut regularly.*

Plant	Qualities	Defects
Tephrosia candida	Lives long, leaves abundant, decomposition slow *	
Clitoria cajanifolia	dº	
Leucaena glauca	Lives very long, abundant production of seed, stands slight shade.	Very rapid decomposition.
Tephrosia hookeriana var. *amoena*	Adapts itself to poor soils.	
Desmodium gyroïdes	Lives long.	Numerous buds fail to grow.
Indigofera Anil	Lives long, leaves fairly abundant, large production of seed.	Rapid decomposition.

* The slowness of decomposition allows a plant to be used as mulch.

II. — *Green manure plants which may be worked in before planting the main crop, or which may be used as I, but yielding only one cut.*

Plant	Qualities	Defects
Phaseolus calcaratus	Covers the soil rapidly, leaves abundant.	Lives only one year.
Pueraria phaseoloides	Dº	Attacked by flea-beetles.
Crotalaria incana	—	Attacked by several insects, become bushy.
» *striata*	—	
» *laburnifolia*	Leaves abundant.	The stalk becomes woody.
» *quinquefolia*	Rapid growth, gives in a short time a large quantity of leaves, does not become woody.	Destroyed by insects.
» *alata*	Cover the soil rapidly, do not become woody; *ferruginea* has a special abundance of leaves.	Destroyed by insects.
» *ferruginea*		
» *juncea*	Rapid growth on good soil.	Must be thickly sown, lives only 6 months.
Vigna sinensis	Grows rapidly, leaves abundant.	—
Cassia mimosoides	Rapid growth, great quantity of seed.	Must be thickly sown, lives only 6 months.
» *patellaria*	Dº	
Canavalia ensiformis	Adapts itself to very bad soils.	—

III. — *Climbing green manure plants which can be used as I.*

Plants	Qualities	Defects
Centrosema Plumieri	Luxurious growth, throws out roots at every node, does not climb much, yields much seed, even on the ground; can live three years.	Climbs a little, so the main crops must be disengaged every six weeks.

IV. — *Climbing green manure plants which can be used only by working them in before planting the main crop.*

Mucuna sp. with violet flowers and white seeds.	Luxurious growth.	Attacked by disease and dies in 9 months.
Phaseolus lunatus	Lives 2 years.	

The writer gives the following data on *Tephrosia:*

	Yield of green leaves per acre	Quantity of seed required per acre
T. candida	8 480 lbs.	112 lbs.
T. hookeriana	7 580 »	121 . »
T. Vogelii	8 030 »	136 »

105 – **Comparative Manuring Experiments with Calcium Cyanamide, Nitrogen Lime, Nitrate of Soda and Sulphate of Ammonia on Sandy and Peaty Soils.** – TACKE, BR. and BRÜNE, FR. in Die *landwirtschaftlichen Versuchs-Stationen*, Vol. LXXXIII, Part I-II, pp. 1-100. Berlin, 1913. (1).

In order to throw further light on the results previously obtained by other experimenters, some experiments on the use of calcium cyanamide (Kalkstickstoff) and nitrogen lime (Stickstoff-kalk) in comparison with nitrate of soda and sulphate of ammonia, were conducted on sandy and peaty soils by the Bremen Experiment Station for Moor Cultivation.

The results for the years in which the nitrogenous manures had a fair or good effect are given in Tables I and II.

(1) See No. 491, *B* March 1912 (*Ed.*).

TABLE I. — *Comparative effects of the various nitrogenous manures according to the crops.*

Crops	Relative yields: crop of grain and straw or tubers due to nitrate of soda = 100.						
	Nitrate of soda	Sulphate of ammonia	Cyanamide or nitrogen lime; when given.				
			3 to 4 weeks before sowing	2 weeks before sowing	1 week before sowing	with seed	as top-dressing
I. *Sandy soils.*							
Rye: average . . . grain . . .	100	73	—	—	—	—	67
Rye: average . . . straw . . .	100	82	—	—	—	—	54
Oats: average . . . grain . . .	100	71	114	62	95	44	77
Oats: average . . . straw . . .	100	82	91	60	66	46	82
Potatoes: average, tubers . . .	100	—	100	75	88	107	95
Total average: grain or tubers . . .	100	72	107	69	92	76	80
Total average: grain or tubers . . .			89				
Total average: grain or tubers . . .					85		
Total average: straw . . .	100	82	91	60	66	46	68

			Cyanamide			Nitrogen lime	
			3 weeks before sowing	with seed	as top-dressing	with seed	as top-dressing
II. *Peaty soils.*							
Rye: average . . . grain . . .	100	92	—	—	66	—	66
Rye: average . . . straw . . .	100	103	—	—	64	—	68
Oats: average . . . grain . . .	100	85	69	67	82	33	83
Oats: average . . . straw . . .	100	88	63	55	72	27	92
Potatoes: average, tubers . . .	100	—	56	52	83	—	—
Total average: grain or tubers . . .	100	89	63	60	77	33	75
Total average: grain or tubers . . .				67		54	
Total average: straw . . .	100	96	63	55	68	27	80
Total average: straw . . .				62		54	

TABLE II. — *Utilization by cereals of the nitrogen of the various fertilizers.*

Crops.	Amount taken up by crops on 100 parts of nitrogen given			
	Nitrate of soda	Sulphate of ammonia	Cyanamide	Nitrogen lime
I. *Sandy soils*				
Rye : average	51	29	30	30
Oats »	56	54	30	26
Total »	*54* (100)	*42* (78)	*30* (56) (54)	*28* (52)
II. *Peaty soils*				
Rye : average	42	42	23	37
Oats »	55	55	32	37
Total »	*49* (100)	*49* (100)	*28* (57) (67)	*37* (76)

As for the relative action of cyanamide compared with nitrogen lime, the results on sandy soils are given in Table III.

Number of experiment	Year in which experiment was made	Dressing of nitrogen in manure lbs. per acre	Crops	Increase of crop over non-nitrogenous manure lbs. per acre			
				Cyanamide		Nitrogen lime	
				grain	straw	grain	straw
I	1908-09	40	Rye	854	1050	727	1022
I	1910	40	Oats	167	282	184	385
I	1910-11	40	Rye	621	834	539	811
			Average . . .	*547*	*722*	*484*	*740*
			Relative effect . .	**100**	**100**	**88**	**92**

CONCLUSIONS.

I. The opinion of several experimenters that the effects of nitrogen lime prepared by the Polzenius process were the same as those of calcium cyanamide prepared by Frank's process, seems to be confirmed as to sandy soils

by the present experiments. On peaty soils however it appears that such is not the case, for the average effect of nitrogen lime was only 91 per cent. of that of calcium cyanamide; however within the individual experiments the deviations in the results disappear more or less completely and nitrogen lime shows an even better utilization of nitrogen; nevertheless it is problable that the chloride of lime which enters into the preparation of nitrogen lime is not without effect on acid soils such as peats, and is liable under certain circumstances to be injurious.

II. In order to obtain the best possible results in sandy and peaty soils with cyanamide and nitrogen lime, it is necessary according to the above experiments to pay attention to the following points:

a) Calcium cyanamide must never be spread together with the seed as it injures its germinative energy; oats appear the most sensitive to this action, especially in sandy soils, and in this case the effect of cyanamide is only 44 per cent. of that of nitrate of soda.

b) As a top-dressing, calcium cyanamide does not give the best results, especially with rye, on either sandy or peaty soils; in the case of a late top-dressing on rye, where the effect of nitrate of soda was taken as equal to 100, the effect of calcium cyanamide was 67 on sandy soil, and 66 on peaty soil. On oats and potatoes the effect was better, being 80 per cent. on sandy soil and 82 per cent. on peaty soil of the effect of nitrate of soda, a little less than when it was applied some time before sowing.

c) The best results with cyanamide were always observed when it was given some time before sowing, especially in sandy soil, when it averaged 89 per cent. of nitrate of soda. On giving cyanamide eight days before sowing and harrowing it in immediately after spreading, no injurious action on the germinative energy of the seeds is noticed; this short time seems to be enough for the processes of transformation which take place in contact with the moist soil to proceed sufficiently to cause the toxic character of the initial products of decomposition to disappear completely.

d) The utilization by plants of the nitrogen in cyanamide is inferior to that of the nitrogen in sulphate of ammonia and in nitrate of soda; taking the utilized nitrogen in the latter as 100, that in cyanamide averages 54 in sandy soils, and 67 in peat soils.

III. Whilst it appears to be confirmed that cyanamide opportunely and suitably used is an efficient manure for sandy and peaty soils, farmers must consider before using it extensively if this manure is offered at a suitable price, because, owing to the superiority of nitric nitrogen, this element in cyanamide must be quoted at a correspondingly lower price.

106 – **Nitrogenous Fertilizers Obtainable in the United States.** (1) – TURRENTINE, J. W. — *Bulletin of the U. S. Department of Agriculture*, No. 37, *Contribution from the Bureau of Soils*. Washington, December 8, 1913.

The following materials constitute the present sources of nitrogenous fertilizers in the United States:

(1) See INSTITUT INTERNATIONAL D'AGRICULTURE, *Production et consommation des engrais chimique dans le monde.*

Artificial nitrates (calcium and ammonium).
Nitrate of soda.
Sulphate of ammonia.
Fish scrap or guano.
Tankage or slaughter-house refuse.
Dried blood.
Cottonseed meal.

The home production in 1912 was as follows :

Sulphate of ammonia	138 400 tons	(155 000 short tons) (1)
Calcium cyanamide	4 000 »	
Tankage	222 535 »	
Dried blood	79 794 »	

12 000 tons of cyanamide were also produced at Niagara Falls, Ontario, Canada.

The figures for tankage and dried blood are calculated from the total slaughter of live stock in the country, but only the larger slaughter-houses utilize their waste products to the best advantage.

To the production must be added the imports, as follows:

518 613	tons of nitrate of soda	(1911)
2 302	» » lime	»
60 000	» sulphate of ammonia	(1912)

The consumption during the same period is given in the following table.

Sources of Nitrogen used in Mixed Fertilizers in the United States.

Material	Amount used	Nitrogen content	Nitrogen yielded by fertilizer
	tons	per cent.	tons
Sulphate of ammonia (2)	198 400	19.75	—
Nitrate of soda	70 000	15.5	10 850
» lime	—	12.75	—
Calcium cyanamide	11 264	18.0	2 028
Cottonseed meal	—	6.5	—
Tankage . . Bu. of Animal Industry . .	161 950	6.5	10 527
Tankage . . Lodge	99 324		6 456
Fish scrap	70 000	9.0	6 300
Dried blood Bu. of Animal Industry . .	57 473	11.0	6 322
Dried blood Lodge	37 710		4 148

(1) According to the *American Coal Products Co.*, New York, the production in 1912 was 147 000 tons. (*Ed.*).

(2) According to the *American Coal Products Co.*, New York, this figure should be 207 000 tons. (*Ed.*).

The figures for sulphate of ammonia may be too large, as they include the proportion of the substance which was employed otherwise than as a fertilizer. Those for nitrate of soda were obtained by taking 13 per cent. of the total imports, that being the amount which is attributed to fertilizers; and this estimate may be somewhat low, as 5 per cent. of the imports are unaccounted for and may also be used in the fertilizers industry. Two sets of figures are given for tankage and dried blood. They are based on the respective estimates of slaughter in the United States made by the Bureau of Animal Industry and by Mr. F. S. Lodge. The Bureau of Animal Industry derived their estimate of the slaughter partly from the number of animals killed under government inspection, which they regard as 60 per cent. of the whole.

107 – **The Situation of Guano in Peru.** — 1. Annual Report of the Guano Company, « Compañia Administradora del Guano, Limitada », in *Peru To-Day*, Vol. V, No. 4, pp. 858-859. Lima, July 1913. — 2. BILLINGHURST. The President's Financial Message. — *Ibid.* No. 6, pp. 944-968. September 1913 (1).

In the financial message of the President of the Republic of Peru to Congress the following information is found:

According to the contract of January 11, 1890, between the Peruvian Government and the "Peruvian Corporation Limited", the latter was granted, besides other concessions, the following:

a) — The guano existing in Peruvian territory up to the amount of three million English tons, which amount was subsequently reduced to two million tons.

b) — The surplus over 50 per cent. of the guano on the Lobos Islands, which belonged to Peru, after liquidating accounts with Chile.

In accordance with clause 21 of the contract of January 11, 1890, that Corporation has exported from the Peruvian deposits the following quantities of guano:

Years	Tons declared
1891 to 1895	166 877
1896 to 1900	122 739
1901 to 1905	350 169
1906 to 1910	382 151
1911 to 1913 (April)	112 982
	1 134 918

The proceeds from the guano sold by the Peruvian Corporation from 1892 to June 30, 1912, were as follows:

Years	£
1892 to 1896	376 133
1897 to 1901	322 886
1902 to 1906	808 477
1907 to 1911	712 457
1912	141 143
	£ 2 361 096

(1) See No. 112, *B.* Feb. 1913. (*Ed.*).

Peruvian agriculture has only been able to supply itself with guano from the year 1896 to 1912, as follows:

Years	Tons
1896 to 1900	18 384
1901 to 1905	102 216
1906 to 1910	177 212
1911 to 1912	76 048
	373 860

The annual average for the quinquennial period 1906-10 is 35 442 tons, and the average for the last two years has been 38 024 tons.

The supply for the present year will reach 40 000 tons.

The report of the "Compañia Administradora del Guano Limitada" for its fourth year of operation, from April 1, 1912, to March 31, 1913, gives further particulars on the production and home consumption of guano in Peru (See table on page 206).

The greater part of the high grade guano extracted during the past year has been taken from the South Chincha Island, in conformity with the rotation plan now in effect. Other deposits of minor importance have also been worked in accordance with the Government distribution decree of February 25, 1909.

The quantity of guano extracted by the Company for distribution within the Republic for the past four years in comparison with the demand is as follows:

Year	Demand	Production	Percentage of supply
	Spanish tons		
1909–10	38 577	25 370	60
1910–11	58 901	24 921	39
1911–12	73 901	18 656	20
1912–13	105 771	24 350	20

The Directors state their belief that the increased demand is due principally to the desire of the various users of the fertilizer to secure a full order by ordering more than they require. The directors of the Company propose to adopt measures which will result in a rectification of this irregularity.

The proportion of nitrogen in the high-grade guano excavated and the ruling prices for the four years are given as follows:

Year	Percentage of nitrogen	Price per unit	
		s	*d*
1909–10	10.04	3	2
1910–11	10.70	2	5
1911–12	10.14	2	4
1912–13	9.18	3	0

Table showing deposits worked and detailed production of the Guano Company for the past four years (in Spanish tons). *

Deposits	1909-10		1910-11		1911-12		1912-13		Totals	
	Rich	Poor	Rich	Poor	Rich	Poor	Rich	Poor	Rich	Poor
Isla Sur de Chincha	23 512	—	—	—	—	—	20 083	—	43 595	—
Grupo de Asia	1 163	—	135	—	—	—	91	—	1 389	—
Palominos	372	—	—	—	—	—	1 128	—	1 500	—
Fronton	—	850	—	—	—	—	—	—	—	850
Isla Centro de Chincha	—	—	20 811	—	—	—	—	—	20 811	—
Sombrerillos	—	—	648	642	1 320	—	361	—	2 329	642
Viejas (Bahia Independencia)	—	—	—	8 655	—	1 950	—	12 242	—	22 847
Pachacamac	—	—	—	855	—	—	—	—	—	855
Islas Norte de Chincha	—	—	—	—	15 488	18 850	—	—	15 488	18 850
Punta Negra	—	—	—	—	873	—	—	—	873	—
Obillos e Isla Blanca	—	—	—	—	691	—	886	—	1 577	—
Isla Ocoña	—	—	—	—	284	—	171	—	455	—
Santa Rosa	—	—	—	—	—	—	1 354	—	1 354	—
Olleros	—	—	—	—	—	—	276	—	276	—
Other small deposits	323	—	3 327	—	—	—	—	—	3 650	—
	25 370	850	24 921	10 152	18 656	20 800	24 350	12 242	93 297	44 044

* The Spanish ton used in Peru = 2028.66 lbs. English.

Summary.

	Rich	Poor	Total
1909-10	25 370	850	26 220
1910-11	24 921	10 152	35 073
1911-12	18 656	20 800	39 456
1912-13	24 350	12 242	36 592
	93 297	44 044	137 341

The prices of low-grade guano containing less than 3 per cent. of nitrogen for the past two years have been as follows :

Year	£.	s.	d.
1911–12	1	9	3
1912–13	2	0	0

Lastly, in the above-mentioned financial message, the President of the Peruvian Republic states that from the year 1841, when the exportation of guano commenced, to the year 1879, Peru exported over 12 million tons of that fertilizer, with a net profit to the State of about £80 000 000.

The expert ornithologist, Dr. H. O. Forbes, who had been invited by the Guano Company and by the Government to report upon measures to be adopted to prevent the disappearance of the guano-producing birds, presented his report to the Government at the end of April 1913.

108 – **Sulphate of Copper: Production, Trade and Consumption.** — CRIVELLI, E. in *L'Industria Chimica*, Year XIII, No. 24, pp. 369-374 + 1 diagr. Turin, December 25, 1913.

Following on the diffusion of Millardet and Gayon's works (1885) on the influence of copper compounds on vine mildew, all the measures suggested for the control of the parasite were modified and only the active substances (sulphate of copper and lime) were retained. Nevertheless during several years the double sulphates of copper and iron, copper and zinc and also of copper and nickel were still used, and the chemical works, before starting resolutely the manufacture of sulphate of copper on a large scale, hesitated for some time between the production of pure sulphate of copper and the double salts.

The sulphate of copper industry commenced in England between 1885 and 1890. In 1894, that country exported 786 metric tons (1), almost equally divided between Italy and France. The development of production in the whole world is shown by Table I (pp. 208-209).

As for the consumption of sulphate of copper, the data in Table II have for the most part been taken from the *Recueils statistiques sur les métaux*, etc., from the "Metallgesellschaft" and "Metallbank und Metallurgische Aktien gesellschaft" of Frankfort-on-the-Main.

In the consumption of sulphate of copper, Italy occupies the first place. The diagram of the consumption of sulphate of copper in Italy shows decided periods of minima which last always two years. These are years in which the favourable weather limits the consumption of sulphate and the vines yield heavily. Such years are usually followed by one in which the vines are still in good condition and do not require excessive care, whilst the vine growers are not inclined to spend much on account of the low prices of wine due to the heavy crop.

It is also to be remembered that statistics do not consider the probable quantities remaining in the hands of small tradesmen and consumers.

(1) 1 metric ton = 0.9842 English ton.

TABLE I. — *Production of sul ph*

COUNTRY	1894	1895	1896	1897	1898	1899	190
United Kingdom (1)	36 207	40 091	53 464	60 236	53 112	40 836	43 5
Italy	2 982	3 151	4 756	5 337	6 164	7 795	13 1
United States (2)	—	21 700	22 100	23 600	25 000	30 800	34 9
France (3)	—	—	—	—	—	—	—
Austria (3)	—	—	—	—	8 300	9 200	8 3
Germany	4 809	4 638	6 838	6 400	4 838	5 700	5 3

(1) As it is impossible have precise information on the production of the English works, t
(2) These figures are taken from The *Engineering and Miniug Journal* and include the sulpha
(3) Approximate data from a private enquiry made by the Metallgesellschaft and by t

TABLE II. — *Consumption of sulphate of copper (in metric tons).*

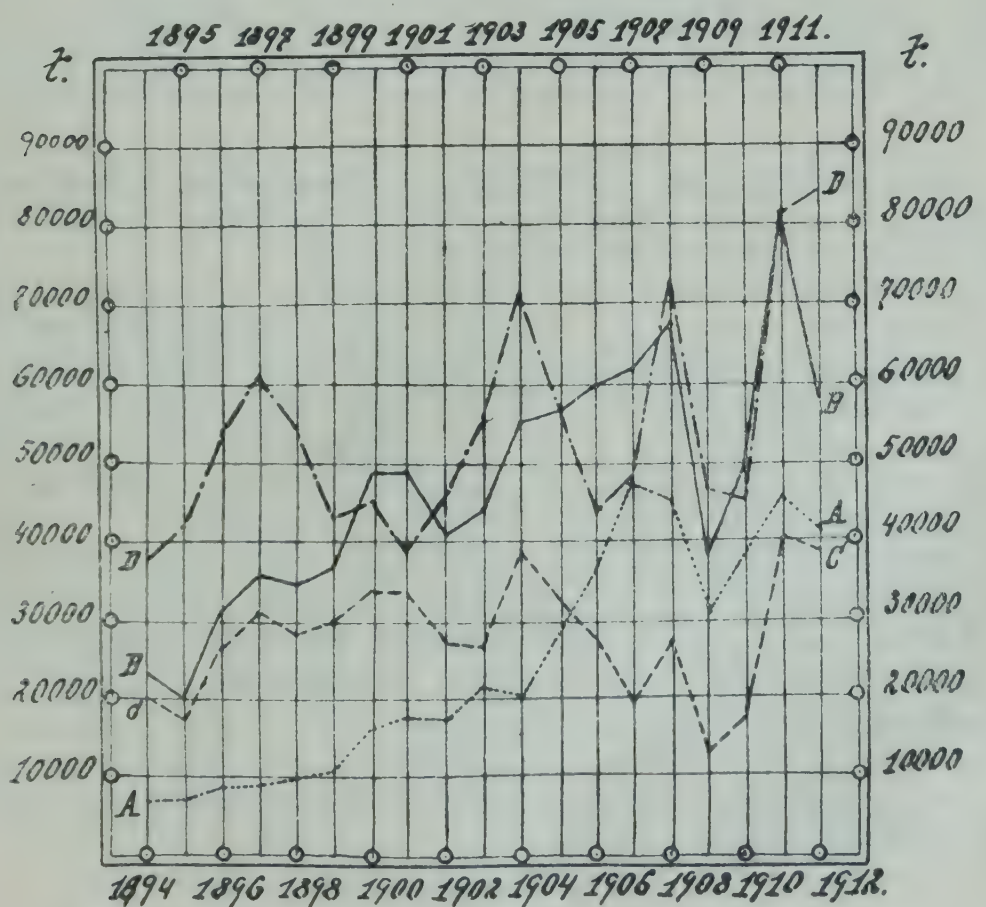
COUNTRY	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912
Italy	42 700	54 500	56 600	59 200	60 400	66 900	36 500	49 150	81 400	58 180
France	—	—	—	—	21 800	36 800	32 300	31 900	34 900	34 700
Austria	11 800	14 400	13 900	12 200	14 970	19 700	14 390	15 160	20 690	31 200
Germany	5 000	6 100	7 300	5 500	7 800	9 200	11 500	7 100	8 300	12 000

copper (in metric tons).

901	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912
600	44 000	54 300	71 400	56 800	43 600	46 000	72 400	45 600	43 400	81 100	85 500
374	14 601	18 164	17 237	26 212	34 276	45 264	42 598	28 551	36 236	43 626	40 000
200	21 800	19 600	28 800	24 000	23 200	20 400	17 200	20 400	12 400	15 200	18 000
—	—	—	—	—	—	15 000	24 000	25 000	26 000	25 000	26 000
600	8 200	8 300	10 000	10 200	10 400	11 000	11 400	10 300	11 800	14 100	15 200
500	5 200	5 200	6 584	6 988	6 758	5 284	7 117	6 211	5 209	7 500	8 700

ures of the quantities exported are here given.
opper obtained as a by-product in the metallurgical works which treat copper ores.
tallbank of Frankfurt-on-the-Mair.

Consumption of sulphate of copper in Italy from 1895 *to* 1911 *(in metric tons), compared with exportation from England, etc.*



A. Production of sulphate of copper in Italy. — B. Consumption in Italy. — C. Importation into Italy. — D. Exportation from England.

These stocks, which would weigh heavily on the statistics, come into play in producing the apparent diminished consumption observed in the years following an abundant crop. It follows that the increase of consumption rarely increases abruptly after a year of minimum consumption. Independently of any other cause, it is very probable that the ratio between the consumption of 1913 and that of 1914 will be the same as that between other periods of minima, as 1898-99, 1902-03, 1909-10.

AGRICULTURAL BOTANY. CHEMISTRY AND PHYSIOLOGY OF PLANTS.

109 – **Criticism of the Experiments on the Influence of Atmospheric Electricity on Plants.** — LESAGE, PIERRE in *Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences*, Vol. 157, No. 18, pp. 784-787. Paris, November 1913.

The retardation in the growth of plants under metallic cages was supposed to be due to their protection from atmospheric electricity. Experiments were carried out with cress and also with *Datura Tatula*, and to eliminate the effect of the cage structure a batch of plants were grown in a silk cage of exactly similar dimensions to the iron wire cage containing a similar batch of plants. At the end of the three months the plants in the control batch grown in the open air were distinctly larger than the others, but there was no perceptible difference between the plants grown in the different cages. Further experiments on the evaporation of water from a plain surface showed that a cage of small mesh decreased the rate of evaporation by 10 per cent. in still air and by about 30 per cent. in moving air. It would therefore appear that the effect of the cage in diminishing the rate of growth is explained on other grounds than the removal of the influence of atmospheric electricity, even supposing this to exert any influence at all.

110 – **Studies on Differential Mortality in the Germination of Bean Seeds.**, — HARRIS, J. A. in *The American Naturalist*, Vol. XLVII, No. 563, pp. 683-700; No. 564, pp. 739-759. New York, November and December 1913.

The mortality of seeds in field cultures of *Phascolus vulgaris* is not random, but selective with respect to seed weight. Both large and small seeds are less capable of developing into fertile plants and are more heavily drawn upon in the mortality than seeds of the modal region of the seed weight distribution. The mortality of the two extremes, however, is so evenly balanced that the mean weight of the survivors does not differ from that of the whole population, while the variability is reduced.

Additional experiments have been made with 46 000 seeds under laboratory conditions to test the above conclusions. These experiments show that in some varieties the heavier, in others the lighter, seeds are most heavily drawn upon in the mortality and that there is a real biological relationship between weight and viability.

The writer has also shown that in general the larger seeds require longer for germination, but the relation of this to selective mortality is still to be worked out.

111 – **On the Assimilation by Plants of Nitrogen in the Form of Tyrosine, Leucine and Witte's Peptone.** — PETROV, G. G. in *Isvïestia Moscovskago Selskokhosiaistvennago*, Year XIX, No. 5, pp. 163-183 + fig. 4. Moscow, 1913.

The writer grew maize plants inside large glass cylinders which were hermetically sealed and through which a stream of air containing 1 per cent. of carbon dioxide was continually passed at the rate of 100 litres per day. The plants were supported on a wire netting and their roots dipped into a nutrient solution. The whole apparatus including the solution was sterilized by heating before being used and the seeds were immersed in a 1 per cent. bromine solution — the efficiency of the sterilization being proved by the fact that no micro-organisms were present in the jars at the end of the experiment. The jars were kept in diffused light for from 40 to 64 days.

The nutrient solution in each jar received one of the following nitrogenous compounds : tyrosine, leucine, Witte's peptone, calcium nitrate. At the end of the experiment the plants were carefully weighed and analysed for total and albuminoid nitrogen, for asparagine, and for ammonia.

From the results thus obtained and other existing data relevant to the subject of nitrogen assimilation by plants, the writer draws the following conclusions :

1) Both amino acids (tyrosine and leucine) and Witte's peptone are absorbed by plants and the nitrogen they contain is assimilated ; plants are therefore capable of absorbing not only amide but also amine nitrogen.

2) The increase of dry matter and the quantity of nitrogen assimilated by plants fed on the three above substances present two parallel series of figures, in both of which the peptone plants are first in order and the tyrosine plants last.

3) Root development is impeded by solutions of the following concentrations : leucine 0.04 per cent., tyrosine 0.05 per cent., and peptone 0.03 per cent. In these concentrations, while peptone only arrests slightly the development of lateral roots, leucine and more especially tyrosine hardly allow any development of the root at all.

4) Leucine, and to a still greater degree tyrosine, cause a shortening of the roots with an accompanying thickening of the cellular membranes and a consequent abnormal thickening of the roots themselves.

5) As a result of both the present and past experiments with ammonia, asparagine, and calcium nitrate, an inverse ratio is shown to exist between the asparagine and albumen contained by the roots and by the shoots. This confirms the writer's opinion that ammonia absorbed or formed by plants becomes temporarily changed into asparagine, which later forms a nucleus for the elaboration of albumen.

112 — **Individual Variation in the Alkaloid Content of Belladonna Plants.** — SIEVERS, A. in *The Journal of Agricultural Research*, Vol. I, No. 2, pp. 129-146. Washington, November 1913.

Analyses of the alkaloid content of the leaves of individual plants of *Atropa Belladonna* at various stages of growth and in different seasons show :

1) That the leaves can be picked to best advantage from the time of flowering until the early berries begin to ripen. Although the leaves are richer in alkaloids later in the season, they are then too small and sparse for harvesting.

2) That no correlation exists between the general appearance of the plant and the alkaloid content of its leaves, and that luxuriant growth is by no means a criterion of the medicinal value of the plant.

3) That considerable variation exists in the alkaloid content of different plants, thus making it difficult to determine to what extent soil and climate influence the development of alkaloids.

4) That the variation of the alkaloid content of different plants continues in the same direction during different seasons.

113 – **Effects of Illuminating Gas on Vegetation.** – STONE, G. E. in *Annual Report of the Massachusetts Agricultural Experiment Station*, Year 25, No. 31, Part I, pp. 45-60 + 2 plates. Boston, January 1913.

The injurious effects of illuminating and waste gases on vegetation have been studied in considerable detail by the writer. In the case of the Carolina Poplar (*Populus deltoides* Marsh) the characteristic toxic effects consist of a splitting of the bark and a swelling of the tissues, and later an exudation of slimy mucilage. During the incipient stages the poisonous constituents of the gas appear to have a direct stimulating effect on cell division.

Experiments with willow cuttings grown in water charged with illuminating gas showed that :

1) The development of new shoots and roots began from 4 to 11 days earlier than in ordinary tap water.

2) When the water is charged with the gas more frequently, no further increase of development occurs, but the symptoms of gas poisoning appear earlier.

3) The stimulation of the roots is more vigorous than that of the shoots, the increase in length of the former exceeding 600 per cent., whilst that of the latter is about 200 per cent.

The increased root development is attributed to the attenuation of oxygen in the water, and this theory is supported by the increased development of the lenticels under the action of the gas.

The effect of illuminating gas on dormant willow cuttings was then tried, and it was found that the development of the cuttings was accelerated by treatment in an atmosphere of the gas of from 24 to 72 hours' duration.

114 – **Variations in Osmotic Pressure in Potatoes during Storage.** — BRANNON, M. A. in *The Botanical Gazette*, Vol. LVI, No. 5, pp. 433-438 + figs. 1-4. Chicago, November 1913.

In studying the changes taking place in potatoes during storage, observations of the variations in osmotic pressure afford interesting information. Determinations were made in a Beckmann apparatus according to Hamburger's method.

The results showed that :

1) Heat is a factor controlling the processes which give rise to the substances causing variation in the osmotic pressure of potato sap.

2) Low temperatures increase the osmotic pressure and also the acidity, which appears to be the controlling agent in the release of the enzymes hydrolising starch and hemi-cellulose.

3) The carbohydrates hydrolised furnish the energy required by the potato in carrying on its metabolism during cold storage.

Examination of the cell structure of stored potatoes showed that at lower temperatures the cell walls become thinner and more brittle, while with increase of temperature they became tougher.

PLANT BREEDING.

115 – **The Inheritance of Blossom Colour in Beans *(Phaseolus)*.** — SHAW, T K. in *Annual Report of the Massachusetts Agricultural Experiment Station*, Year 25, No. 31. Part I, pp. 182-203 + 1 plate. Boston, January 1913.

This paper is an account of five years' work on the inheritance of blossom colour in beans (*Phaseolus*). The results so far obtained appear to point to a correlation between blossom colour and seed-coat colour, and it is hoped that more complete analysis of the 1913 results will clear up many difficulties concerning the inheritance of blossom colour.

116 – **Seed Selection of Egyptian Cotton in Arizona.** — KEARNEY, T. H. — *Bulletin of the U. S. Department of Agriculture*, No. 38, 8 pp. Washington, November 19, 1913.

Many varieties of Egyptian cotton have been introduced into Arizona for purposes of acclimatisation and plant breeding. One of these, Mit Afifi, was cultivated and selected for some five or six years, but without improvement. In 1908, however, a superior type appeared amongst the progeny and gave rise to a new variety possessing large bolls and long cream-coloured fibres and quite uniform in its progeny. This variety, known as Yuma, is now grown extensively in the Salt River Valley ; it apparently originated as a mutation, and, although it breeds true, it is of great importance to adopt measures to prevent deterioration by cross-fertilization with foreign varieties and by the appearance of inferior mutants. This work can best be done under the guidance of the local Cotton Growers' Associations and the Department of Agriculture.

117 – **The Breeding of Medicinal Plants.** – MILLER, F. A. in *The American Breeders' Magazine*, Vol. IV, No. 4, pp. 193-201 + 2 figs. Washington, D. C., December 1913.

The selection of medicinal plants yielding higher percentages of their specific drugs offers a rich field of development. The chief difficulty encountered in such work is the testing of individuals by long and expensive chemical and physiological assays, but this can be overcome, in part at least, by seeking correlations between high potency and certain morphological characters.

Amongst medicinal plants that have been improved by this process are the following :

Plant.	Yield of alkaloid.						Remarks.
	Normal			After selection			
	Min.	Max.	Aver-age	Min.	Max.	Aver-age	
	%	%	%	%	%	%	
Atropa Belladonna leaves and roots. .	0.23	0.62	0.43	0.55	0.87	0.72	External characters of this plant are extremely uniform, except yield of leaves and roots, the dry matter of which varies from 139 gms. to 203 gms. between different individuals.
Datura Stramonium and *D. Tatula* . .	—	—	0.34	0.46	0.55	—	
			0.35	0.47	0.65	—	
			0.47	0.44	0.57	0.51	
			0.65	0.43	0.77	0.65	

CEREAL AND PULSE CROPS.

118 – **The Classification of Cultivated Rice.** — 1. KIKKAWA, S. in *Journal of the College of Agriculture, Tokyo*, Vol. III, No. 2, pp. 11-108 + plates 5-8. Tokyo, 1912. — 2. GRAHAM, R. J. D. in *Memoirs of the Department of Agriculture in India, Botanical Series*, Vol. VI, No. 7, pp. 209-229 + plates 1-4. Calcutta, December 1913.

1. — The writer has had the opportunity of examining rices from all the more important rice-growing countries in the world and constructs a very complete and detailed classification. He includes a brief summary of the attempts of previous workers in this field, concluding with a more detailed account of Tanaka's classification published in 1900. He follows Tanaka's system in somewhat greater detail and bases his classification on those characters, morphological and otherwise, which are important only from an agricultural point of view.

It is divided into two parts, one based on differences in cultivation and the other on the utility of the grain.

THE CLASSIFICATION OF RICE WITH REGARD TO ITS CULTIVATION.

(*A*) Aquatic rice.
  (*a*) Early. (*b*) Medium. (*c*) Late.
    (I) Ordinary rice.
      (α) Tall. (β) Medium tall. (γ) Short.
        (1) Awned. (2) Awnless.
    (II) Special rice.
      (α) Giant. (β) Salt rice.
(*B*) Upland rice.
  (*a*) Early. (*b*) Medium. (*c*) Late.
    (α) Tall. (β) Medium tall. (γ) Short.
      (1) Awned. (2) Awnless.

Since the duration of growth of particular rices varies according to the local conditions, any classification including this character must be special for each locality.

Results are given showing the existence of correlation between length of stem and tillering power, and between length of stem and weight of ear.

Giant rices measure above 2 metres in height, and salt rices possess resisting power against injury from sea water.

Other factors considered in this classification are :

1. Colour of glumes and awns.

No correlation exists between the colours of the various parts of the unhulled grain.

2) Colour of the stem and leaf.

3) Long-glumed rice.

These rices have very long empty glumes, sometimes exceeding the flowering glumes.

4) Double rice.

Varieties containing more than one ovary in a spikelet.

5) Form of panicle.

6) Colour of stigma.

CLASSIFICATION OF RICE WITH REGARD TO THE UTILITY OF THE GRAIN.

This classification divides the varieties into two groups, the non-glutinous and the glutinous, each of which is subdivided as follows :

(I) Slender-grained. (II) Long-grained. (III) Short-grained.

(1) Large-grained (2) Medium-grained (3) Small-grained.

(*a*) Common-coloured.

(α) Ordinary. (β) Scented.

(*b*) Specially coloured.

Glutinous rices contain sugar and dextrin and are only used in confectionery. The non-glutinous rices are the ordinary table rices.

Grains are classified according to their dimensions as follows: ratio length: breadth > 3 = slender-grained; < 3 and > 2 = long-grained; < 2 = short-grained; the product of length $\times$ breadth > 18 or 19 = large-grained, < 15 or 16 = small-grained.

Other important characters are :

1) Shape of the hulled and unhulled grains.

This character has some connection with the taste and process of whitening.

2) White-abdomened rice.

This is the name given to those rices possessing a white chalky- looking portion in the middle of the ventral side, that is the side of the grain in which the embryo is situated. Such grains are more easily broken and have a lower specific gravity.

This scheme is adopted in the classification of Burmese rices, which the writer gives in an appendix of 76 pages.

2. — This is a preliminary note on the progress of the work of the last five years on the classification of the rices of the Central Provinces, India. It includes an introductory account of the acreage under rice and the character of the soils in this area.

The classification adopted follows somewhat the lines of that of Kikkawa, but gives more attention to characters of no direct agricultural value, such as the colour of the ligules and sickles (auricles), the length of the peduncle, the type of inflorescence (whether erect, curved or drooping), the arrangement of the spikelets, the shape of the rachilla, and the characters of the apiculus and awn.

The writer gives a classification of a number of non-glutinous rices of the Central Provinces, based chiefly on their vegetative characters and to a less extent on the dimensions of the grain and spikelet.

119 — **The Gases of Swamp Soils; their Composition and Relationship to the Growth of the Crop.** — HARRISON, W. H. and SUBRAMANIA AIYER, P. A. in *Memoirs of the Department of Agriculture in India, Chemical Series*, Vol. III, No. 3, pp. 65-106, plates 1-4 + figs. 1-6. Calcutta, October 1913.

Considering the apparent inconsistencies in the customs of the natives with regard to the time and manner of applying green manures to their paddy fields, it seemed desirable to make a detailed study of the conditions of growth in such soils before any guidance or improvements could be suggested. With this object in view, a study of the soil gases was undertaken as being the most promising field of enquiry.

Disturbance of the soil puddle in paddy fields liberates the soil gases, which bubble through the irrigation water. Analysis of these gases showed that they consist chiefly of methane and nitrogen in widely varying proportions, with small and variable amounts of carbon dioxide, oxygen and hydrogen. A study of this variation showed that before planting out the proportion of methane is high and that of nitrogen low, while after planting the seedlings, the proportions of the gases are reversed, the hydrogen being in excess. This continues until the ripening of the crop, after which stage the proportions of methane and nitrogen approach those of an uncropped soil.

Analysis of the soil gases immediately after flooding the fields shows that the anaerobic condition commences within a few days, and long before planting out.

These experiments lead to the conclusion that the plant absorbs its supplies of nitrogen in the form of ammonia and nitrogenous organic compounds, and that the crop restricts the formation of methane and hydrogen, either by retarding the rate of fermentation or by the absorption by the roots of a portion of the intermediate products of decomposition.

Analysis of the surface gases showed that they consist of oxygen and nitrogen; carbon dioxide, methane and hydrogen were absent. Studies on the variation in composition of these gases showed that during the period of active growth of the crops the percentage of oxygen was reduced, and that the application of organic manure increased the production of oxygen, while destruction of the algal slime by means of copper sulphate solution

considerably decreased it. Decreased production of oxygen was also associated with a decreased production of nitrogen.

These experiments lead to the conclusion that the roots of the rice plant absorb oxygen and that most of this oxygen is produced by the algal slime in the water, excess of oxygen being evolved in the form of bubbles into which the nitrogen dissolved in the water diffuses according to Dalton's Law. The increased activity of the slime organisms, due to the decomposition products of the organic matter in the soil, results in an increased output of oxygen and a consequent greater root activity of the crop.

Artificial drainage and aeration of the soil increases the root development within narrow limits, beyond which destruction of the algal slime takes place and nitrification probably begins. The beneficial effects of limited drainage appear to be due to the removal of toxic decomposition products and aeration of the roots. The writers are therefore led to conclude that the drainage of paddy soils requires very careful consideration and except in toxic soils is better replaced by a natural system of root aeration effected by green manuring and the development of the algal slime.

120 – **The Sweet Potato as a Cover Crop in Coconut Plantations.** — SCHAEFFER, G. Entretien économique d'une jeune cocoterie. — *L'Agronomie Coloniale*, Year I, No. 5 pp. 136-137 + 2 plates. Paris, November 1913. ROOT CROPS.

During a visit to the Malay States in 1913, the writer saw young coconut plantations in which sweet potatoes (1) were grown as a cover crop on black peaty soils with excellent results.

The advantages of this crop are : 1) its rapid growth and spreading habit, giving complete protection to the soil ; 2) reduction in expenses of cultivation ; 3) natural decay of the plant when the trees reach maturity.

121 – **Cotton Cultivation and the Cotton Industry throughout the World.** - WOEIKOF, A. in *Annales de Géographie*, Year XXII, No. 126, pp. 385-398. Paris, November 15, 1913. FIBRE CROPS.

The average yield of cotton from each country during 1907-10 is given in the followibg table :

	Millions of tons.	Percentage of total.	Yield per acre.
United States	2 454	62.2	180 lbs.
India	695	17.7	72 lbs.
Egypt	292	7.4	410 lbs.
Russian Empire	172	4.3	—
China	132	3.4	—
Brazil	76	1.9	—
Peru	22	3.1	—
Mexico	26		—
Turkey	16		—
Persia	15		—
Other Countries	42		—
Total	3 942		

(1) The sweet potato (*Ipomoea campanulata*) or « Ubi », is a favourite vegetable of the various Asiatic races of the Malay Peninsula. (*Ed*)

The value of the world's total production of cotton is about 250 millions sterling. The most important producing country is N. America, but further development is hindered by unsuitable climatic conditions in the west and south and the scarcity and dearness of labour, the latter being an almost insuperable difficulty. Further development in Egypt is also improbable except in the higher regions, which will only produce inferior varieties of cotton.

Besides, these countries have reached their highest yield per acre. In 1901-02 the yield per acre in Egypt was 460 lbs. per acre, while in the years 1908-10 it had fallen to 370 lbs.

The ideal conditions required for successful cotton cultivation are: *a*) a soil with abundant moisture; *b*) a low rainfall; *c*) abundant sunshine; *d*) a humid atmosphere, and *e*) an abundant supply of labour. These conditions are to be found in Asia, particularly in India, Turkestan and Mesopotamia, and it is in these countries that future developments in the cultivation of cotton will take place. Some parts of Nigeria abundantly supplied by the Niger also offer great possibilities of development in this direction, almost equal to those of Mesopotamia.

122 – **Studies of the Primary Market Conditions of Cotton in Oklahoma.** — SHERMAN, W. A.; TAYLOR, FRED; and BRAND, C. J. — *Bulletin of the U. S. Department of Agriculture*, No. 36, pp. 1-36. Washington, D. C., November 15, 1913.

The system of handling and marketing cotton in vogue today has become extremely complicated owing to the needs and demands of the middlemen, who at best have only a temporary interest in the product, while the claims of the grower and the requirements of the consumer are mostly ignored. This investigation was undertaken in Oklahoma to abtain exact information of the state of things and the various factors controlling the market price of cotton. The questions investigated on behalf of the grower comprise the following:

1) The proper grading of the cotton.
2) The premium obtained for the higher grades.
3) Unjust reduction for low grades.
4) Variations in market price from town to town.
5) Variations in local markets.
6) Relation of farmer's selling price to spinner's buying price.

The investigations were carried out in 103 towns; over 3 200 bales of cotton were sampled and graded, and records were made of the date, place of sale and price paid to the grower. No evidence was obtained that any attention is paid to the variety of short-staple cotton when fixing the price, and the only characters of an improved variety that are of any value to the grower are its yield and its percentage of lint.

The results of the investigation are summarised as follows:

1) The ginners pay nearly the same for all cotton purchased on a given day, whether buying in seed or in the bale.

2) In street markets where there are large numbers of buyers, widely differing prices are paid on the same day for bales of identical quality.

3) The premiums on grades above middling are only one-half those quoted on the New York Stock Exchange, and the premiums actually paid in open street buying are considerably less than those advertised for such grades.

4) Accurate knowledge of cotton grading is of little value to the producer under present conditions, and the grading of the larger firms is often forced upon independent ginners and local merchants when their cotton is " taken up ".

5) Length of staple appears to be no criterion in fixing the price of the individual bale in most districts, but certain farms receive slightly higher prices than others because of reputed superiority of average staple. The prices paid to farmers are too largely based on a system of averages, which discourages the improvement and adoption of better varieties.

6) The present evils may be remedied to some extent by the adoption of a properly organised system of cooperation among growers for the purpose of grading before marketing, but present conditions would probably necessitate a rather expensive selling department.

123 – **Report on the Flax Experiments at Dooriah (Bengal) during 1912-13.** — VANDEKERKHOVE, E. M. in *Agricultural Research Institute, Pusa, Bulletin* No. 35, pp. 1-15. Calcutta, 1913.

This bulletin contains the results of field experiments with flax, and tables showing the working and manufacturing outlay and the approximate balance.

The following results were obtained:

Average Yield.

	in maunds per bigha	per acre
Rippled straw	288.05	82.25 cwt.
Seed	261.75	75.0 »
Flax fibre	3.5	98 lbs.
Tow	3.12	87.36 »

The total expenditure at Dooriah, including interest on capital (8 per cent.) and freight and shipping charges, amounted to Rs. 7 693, and the returns from seed and fibre harvested amounted to Rs. 14 396, leaving a balance of Rs. 6 703 from 83 bighas, or Rs. 91 per acre. The corresponding profit in 1911 was Rs. 89 per acre, thus making an average of Rs. 90 or £ 6 per acre for the two years.

On the central factory system the profit from the planters' point of view works out at Rs. 29 per acre and from the *assamis'* point of view, *i.e.* not charging the cost of labour, Rs. 40 per acre.

The profits from a central factory, including interest on capital, insurance and depreciation, work out at 7.3 per cent. on the capital outlay, which for a factory sufficient for 600 bighas (523 acres) is estimated at 87 300 Rs., or about £5 820.

Details are also given of the cost of labour and the various operations under local conditions.

The seed should always be imported fresh, as it loses its superiority after three years' acclimatization. A three-course or four-course rotation with rice, Rabi crops or indigo gives very good results. Manuring with superphosphate appears to improve the yield of fibre and tow.

124 – **The Present System of Grading Abaca (Manila Hemp); its Defects and Remedy.** — SALEEBY, M. M. in *The Philippine Agricultural Review*, Vol. VI, No. 10, pp. 504-512 + 4 plates. Manila, P. I., October 1913.

Any system of grading in order to be complete and in accordance with the requirements of the consuming market must include the consideration of the colour, strength, length and texture of the fibre. Colour and strength are the most important qualities considered in the lower grades, while the length is ignored unless decidedly below 1 ⅓ meters.

The colour is dependent upon the method and degree of cleaning and drying and on the position of the sheath in the stalk.. The strength of the fibre is also dependent upon these factors, as well as on the variety of the plant, while the texture is chiefly dependent on the variety of the plant and the soil and climatic conditions. The sheaths of every stalk vary in colour and size, thus causing corresponding changes in the fibre ; but the number of grades adopted in commerce is far in excess of these natural variations of the plant and of those due to the methods of preparation. This difference in the interpretation of the same grade between two different establishments is often as great as that between two consecutive grades or marks of the same firm.

To protect the industry from this confusion, the writer recommends the adoption of a Government system of grading.

SUGAR CROPS.

125 – **The Experimental Error in Sampling Sugar-Cane.** — LEATHER, J. W. in *Memoirs of the Department of Agriculture in India*, Vol. III, No. IV, pp. 107-133. Calcutta, October 1913.

Determinations of the sucrose content of individual canes showed that the probable error of the mean of 120 determinations was ± 0.17 per cent. It follows therefore that the error of the determination of a sample of 120 canes will not exceed ± 0.5 per cent. in more than 1 case in 20.

Since the accuracy of a sugar-cane determination does not exceed 0.5 per cent., the determination of a sample of 120 canes will give reliable results.

Selections of canes from different parts of the same plots not exceeding 1 acre in area were made, and it was found that the probable error in such cases was no greater than that of a selection of canes from one definite position, showing that the variation due to soil over an area up to 1 acre was negligibly small compared with that due to individuality amongst the canes.

126 – **Yield and Returns from Palm Oil Trees in French Guinea.** — NICOLAS, L. in *L'Agronomie Coloniale*, Year I, No. 5, pp. 138-143. Paris, November 1913. OIL CROPS.

Experiments on the preparation of palm oil from *Elaeis Guineensis* by the native method during 1911-12 have given the following results:

Total yearly production from 590 trees:

Fruits.		
No of bunches of fruit	2 521	
Total weight	44 300	lbs.
Total weight of fruit	25 570	»
Average weight of fruit per bunch	10.1	»
Oil.		
Total weight of oil extracted by native method	2 073	»
Average weight of oil per bunch	0.82	lb.
Percentage of oil extracted from fruit	8.1	
Palm nuts.		
Total weight of palm nuts obtained	16 208	lbs.
Average weight of palm nuts per bunch	6.43	»
Percentage of palm nuts in the fruits	63.4	
Kernels.		
Total weight of shelled kernels	4 528	lbs.
Average weight of kernels per bunch	1.80	»
Percentage of kernels in the fruit	17.7	
Percentage of kernels in the palm nuts	27.9	

Analysis of the results obtained from the harvests at different times of the year shows considerable variation in the yield of oil and nuts. In May the yield of fruit is much less than in October and January, but the percentage of fruit per bunch and the percentage of oil obtained from the fruits is much higher, whilst the percerntage of nuts in the fruits is much lower.

Annual returns from a plantation of 590 trees:

	£ s
2073 lbs. of oil at nearly 3 *d* per lb. (at Conakry)	24 5
4528 lbs. of kernels and 2200 lbs. of kernels gathered from the ground beneath the trees, making a total of 6728 lbs. of kernels at about 1 ½ *d* per lb. (at Conakry)	42 8
Total income from 590 trees	£ 66 13

Corresponding to a return of 2 *s* 3 *d* per palm tree in bearing.

127 – **Tapping Ceara *(Manihot Glaziovii)*.** — DE WILDEMAN, E. A propos du Manihot. — *Le Caoutchouc et la Gutta Percha*, Year 10, No. 117, pp. 7773-7774. Paris November 15, 1913: after ARENS, P. in *Mededeelingen van het Proefstation Malang*, No. 6. Malang, 1913. RUBBER, GUM AND RESIN PLANTS.

Manihot seems to be advisable where Hevea does not thrive; consequently Dr. Arens has attempted to determine the best method of tapping it. He considers that the half fish-bone as practised on Heveas gives the best results, at least in Java. The yield of the *daily* tappings is 15 grams

for four-year-old trees, a workman being able to tap 200 trees per day. This method appears to allow the quickest healing of the scar.

The writer attaches much importance to the planing down of the bark where the incision is to be made. He warns against long cuts. The knife to be used is a modification of Burgess'.

128 – **An Improvement in the Method of Preparing Brazilian Rubber.** — CAYLA, M. V. in *Journal d'Agriculture Tropicale*, Year 13, No. 149, pp. 329-333. Paris, November 1913.

F. Ripeau has invented a metallic cylinder to replace the stick of the "seringueiro" in the preparation of Brazilian rubber. It consists of an aluminium cylinder rotating about its horizontal axis. The latex is sprayed onto the cylinder and exposed to the action of smoke. The rubber is removed from the cylinder in sheets of about 3 to 5 mm. ($^1/_8$ to $^1/_5$ in.) thick.

The advantages claimed for this method are:

1). Rubber of Fine Hard Pará quality is obtained without its impurities.

2). The purity of the rubber effects a saving in transport.

3). The cylinder, light in weight, is worked by hand and easier to manipulate than the large rollers formerly used.

4). Reduction in labour; 12 litres (2 ½ gallons) of latex can be coagulated in 1 hour by this method as against 1 $^3/_4$ hours by the native method.

129 – **The Standardisation of Plantation Rubber.** – Report of the Rubber Growers' Association, in *India Rubber Journal*, Vol. XLVI, No. 24, pp. 19-24. London, December 13, 1913.

To remedy the unsatisfactory condition of prices for plantation rubber, the Rubber Growers' Association recommends the establishing of a central testing station and the adoption of an approved scheme of standardisation as a basis for determining the market prices of the different grades.

The proposed tests are to comprise: 1) determination of vulcanizing capacity (rate of cure); 2) tests on the vulcanized product, determining tensile properties, physical condition and stability. A high quality of plantation rubber is to be taken as standard quality with an index figure of 1000, inferior grades to be indexed in relation to this standard.

By the adoption of this system of indicating the quality of the rubber to the seller (*i. e.* the producer) and the value to the buyer, the Association hopes for a material appreciation of prices all round compared with prices for finest grades of wild rubber.

VARIOUS CROPS.

130 – **Manuring Tobacco by Spraying the Leaves with Solutions of Potash Salts: Experiments in Hungary.** — COLOMAN, KERPELY in *Köztelek*, Year 23, No. 99, pp. 3330-3331. Budapest, December 24, 1913.

Professor L. HILTNER, Director of the Agricultural Botany Institute of Munich, has drawn the attention of agriculturists to a new manner of using potash salts. He demonstrated in 1911 that potash salts (sulphate and chloride) in suitably diluted solutions, if sprayed onto growing plants, penetrated into them and were absorbed (1). The effects of repeated

(1) HILTNER, L. Ueber eine neue Verwendungsmöglichkeit für Kalisalze und andere düngender Stoffe. — *Mitteilungen der Deutschen Landwirtschafts Gesellschaft*, 1911, 20. Stück 19, 231.

spraying were in so far favourable that the plants submitted to the treatment developed more vigorously and gave a higher yield than those not treated. HILTNER'S experiments were mostly made on white mustard, soya beans and potatoes.

In Hungary the Royal Tobacco Experiment Station at Debreczen conducted a series of experiments with the object of ascertaining whether this method could be applied to the cultivation of tobacco. The experiments made in 1911 gave negative results on account of the unfavourable weather; they were repeated in 1912, using the large-leaved Szegedi Rózsa variety and the small-leaved selected garden Réthát tobacco, on plots 662 sq. yards in extent. Three weeks after the striking of the plants that had been transplanted (June 11) spraying was commenced, a 2 per cent. solution of sulphate of potash being applied by a common knapsack sprayer. The operation was repeated every seven days up to July 24.

At the same time comparative experiments were made between morning spraying after the dew had evaporated and evening spraying before nightfall. In 1912 the weather was favourable to tobacco, as the rains did not begin in Hungary before the middle of August when the plants were already ripening and consequently did not cause any trouble, except during the harvesting and drying. Whilst spraying, care was taken to wet the whole surface of the leaves. With the growth of the plants the treatment involved more labour and proportionately a greater quantity of solution.

With the variety Szegedi Rózsa, planted at distances of 20 × 28 inches (11 200 to the acre), the work was quicker and less expensive than with the Réthát variety planted closer (12 × 20 inches or 27 624 to the acre), as may be seen in Table I.

TABLE I.

Time and quantity of liquid employed in spraying plots of 662 square yards.

Date of spraying	Szegedi Rózsa			Réthát		
	Labour		Liquid used — gallons	Labour		Liquid used — gallons
	hours	minutes		hours	minutes	
June 11	2	—	21.12	5	20	40.48
» 18	2	50	35.20	8	—	59.84
» 25	3	20	42.24	8	40	73.04
July 2	4	40	56,32	12	40	114.40
» 9	5	20	75.68	16	—	132.00
» 16	10	—	119.68	16	—	142.56
» 23	12	—	132.00	17	—	158.40
Total of sprayings	40	10	482.24	83	40	720.72

The expense per acre based on the above data works out as follows :

	Tobacco					
	Szegedi Rózsa			Réthát		
	£	*s*	*d*	£	*s*	*d*
Labour	2	12	7	5	12	4
Sulphate of potash	3	17	4	5	14	10
Drawing water, preparation of solution, carriage, etc.	1	19	2	2	16	2
Total	£8	9	1	£14	3	4

This shows the expense per acre to be considerable for both varieties and distances of planting.

The effect of spraying appears in the more vigorous development of the plant, the greater length of the stems, the more numerous leaves and their fresher colour. This difference was more specially noticed on the plants treated in the morning, while in those sprayed in the evening it was less conspicuous. This fact confirmed the opinion of the writer that the absorption of potash by the leaves was more active in the morning, when the process of absorption begins, than in the evening, which opinion is corroborated by the data on the yields, given in Table II.

TABLE II.

	Plots of 662 sq. yds.	Per acre	Increase of yield per acre	Average number of leaves per stem	Combustibility of the leaves
	lbs.	lbs.	lbs.		seconds
Szegedi Rózsa variety.					
Without spraying	226.2	1593.70	—	12.2	20
Morning spraying	339.2	2390.07	796.37	17.5	48
Evening spraying	277.6	1856.47	362.77	14.7	42
Réthát variety.					
Without spraying	287.5	2026.22	—	15.5	13
Morning spraying	426.8	3007.56	981.34	18.1	22
Evening spraying	367.4	2588.98	562.76	16.6	21

It appears from the above that spraying 2 per cent. sulphate of potash solution improved the combustibility of the leaves and increased the yield, especially when the spraying was done in the morning.

Table III shows the financial results of the treatments.

TABLE III.

Variety of tobacco	Cost of spraying per acre			Value of greater yield				Deficit per acre		
	£	s	d		£	s	d	£	s	d
Szegedi Rózsa	8	9	1	morning	6	15	5	1	13	8
				evening	3	1	7	5	7	6
Réthát	14	3	4	morning	11	2	4	3	1	0
				evening	6	7	5	7	16	0

The final result of the experiments is a loss, in spite of the considerable increase obtained in consequence of the morning spraying and the very favourable weather of 1912.

The writer concludes that the favourable effect of spraying with potash solution under favourable climatic conditions is undeniable, but that the necessary expense is so great that this method will be of no practical importance for tobacco growers.

MARKET GARDENING.

131 – **Experiments in Bulb Growing in the United States.** – DORSETT, P. H. – *Bulletin of the U. S. Department of Agriculture*, No. 28, pp. 1-21 + figs. 21. Washington D. C., November 1913.

Bulb growing has been attempted in various parts of the United States, but with very doubtful success until recently, when the Department of Agriculture opened an experimental bulb garden on a selected plot of ground at Bellingham, Wash. At this station bulbs for forcing have been grown superior to the best imported Dutch bulbs; but when these are grown in other parts of the United States, the same deterioration sets in in subsequent years as with imported bulbs. Experiments are also being conducted with machinery with a view to reducing the cost of production.

It appears that the success of bulb growing in the United States depends chiefly on the suitability of soil and climate.

FRUIT GROWING.

132 – **Present State of Fruit Growing in Greece.** — *Communication from* J. BRICHET, *Fruit Specialist to the Royal Ministry of Agriculture, Agricultural Station of Patras.*

With the development of Greece, both economic and social, there has been a steady development in fruit growing. This growth has been brought about by private enterprise and by the assistance of arbor societies, sometimes supported by the authorities; and although the plantations are not so extensive as in some other parts of Europe, their utility has none the less been realised.

The size and nature of the fruit plantations, now fairly abundant, varies according to the district and the suitability of the particular species for the spot. The Greek is not a systematic cultivator and if he sometimes

reaps great profit from his trees, he owes it entirely to the nature and climate of certain favourable neighbourhoods. Cultural methods other than simple tillage and manuring are neglected. Notwithstanding this fact handsome crops are often obtained. On the slopes of Pelion crops of half a ton of juicy apples are gathered from a single tree, while in the district of Patras and in the Valley of Leonidion in Arcadia pear trees as big as planes may produce each 6 or 8 cwt. of pears. In the Eparchy of Lepanto and in the Peloponnesus, on the slopes of Mt. Chelmos, huge walnuts are found yielding prodigious quantities of fine nuts.

From the fruit growers' standpoint Greece may be divided into two zones: one, the maritime and littoral zone, has a fairly temperate climate and comprises the islands, the slopes of the mountains facing the sea, sometimes cut into by deep and very fertile valleys, and the generally low and often extensive plains between the mountains and the sea; the other, the inland zone, is mountainous and consists of plateaus and narrow valleys at a height of 400 to 1000 m. (1300 to 3300 ft.), with great extremes of climate.

In the most favourably exposed parts of the former zone are found all the citrus fruits (including citrons), as well as almonds, pistachios, Japanese medlars, peaches, carobs, figs, pomegranates and pears on quince stock. In the latter zone, pears on pear stock, apples, walnuts, cherries, apricots, plums, peaches on plum stock, and agriots are cultivated with success.

Owing to the lack of systematic cultivation and technical knowledge, pomology is still in an elementary condition. Most of the varieties, except those recently introduced from other parts of Europe by the Ministry of Agriculture and a few private individuals, are modifications of native varieties produced by changes in climate and stocks upon which they are grafted. They are so numerous and are given such different names in different localities that it is very difficult to classify them. They include some exquisite fruits with heavy cropping powers when systematically cultivated, whose preservation, when local consumption or exportation is not adequate for their utilisation in a fresh state, should prove a profitable industry.

At present fruits are chiefly grown to supply local needs, as in the absence of technical knowledge concerning the production of high-class fruit and its preservation and packing, the export trade is not as important as it should be. The exportation is so far almost confined to citrons from the Islands and the Gulf of Corinth (sent to America), lemons from Paros and Messenia (for England and Russia), and apples from Pelion (for Egypt and the Asiatic coast). Generally most of the fruit is consumed in Greece, Athens taking the bulk and the choicest. Patras, Volo, Chalcis, Lamia, Aighion, Calamata and Nauplia are the chief centres for the producing districts. The price of fruit often reaches exorbitant figures in the market of the capital.

Since the foundation of the Ministry of Agriculture nearly three years ago, there has been a sustained effort towards utilising the natural resources of the Country by developing fruit trees, which form the crop most suited to the somewhat capricious climate. The appointing of French

fruit specialists, the creation of large nurseries to provide growers with suitable trees at reduced rates, the introduction of varieties of greater value, the creation of posts of itinerary instructors to supply the cultivator with advice and information, have all contributed to the rapid development of fruit growing.

Fruits grown in Greece are superior to the same varieties grown in other parts of Europe in taste and colour. Among pears, the varieties Duchesse d'Angoulême, Epargne, Beurré Diel, Beurré Napoléon and Williams' Bon Chrétien have been cultivated in Greece for some years and give abundant yields of succulent fruit with good keeping qualities. Further there exist scattered here and there throughout the country a few imported varieties long since acclimatized and known by the names Bersimi, Canellini, Spinocarpi, Campana and Tsakonika, all yielding excellent fruits with good keeping qualities; great quantities are produced in the districts of Patras and Leonidion in Arcadia. The summer variety Doyenné de Juillet, known in the country as Doukessa, gives an abundance of excellent fruit. We may also mention a variety of summer pear very widely distributed in the Peloponnesus known as Kontopodaroussa, not of very good quality but ripening early in July, which gives rise to a very important local trade.

The varieties of apples are still less known. Besides the excellent and heavy-cropping variety known as Firiki on Pelion, there are only a few varieties introduced by amateurs and grown in a few gardens. From specimens of Reinette grise du Canada, Calville blanc d'hiver and Rambour d'été met with, the writer is convinced that they can be cultivated with success in the interior mountainous region.

Peaches yield first class fruits and their cultivation properly undertaken could give rise to a successful industry in early fruit. Unfortunately the very early varieties for export are not yet adopted.

The walnuts from the Lepanto district are renowned for the abundance and quality of their nuts.

Cherries, agriots, plums and apricots from all the eastern parts of Greece and the island of Euboea might give rise under rational cultivation to a dried or preserved fruit industry.

Olives, dessert grapes and figs are superior to those of any other country on the Mediterranean.

With the exception of the vine, these fruits are rarely made the objects of systematic cultivation. The cultivator generally lacks the rudiments of knowledge of how to treat the trees, and continues blindly in old-fashioned errors and prejudices. This difficulty of finding experienced men is a great drawback to amateurs who would wish to spend their time and capital on fruit growing.

The Ministry of Agriculture, with a view to developing fruit growing as a source of national wealth, is about to set up model establishments at Patras and various other centres to carry out : 1) experiments in fruit cultivation, 2) production of trees for distribution on a large scale, 3) experiments with different stocks and varieties and their acclimatization and uses, and 4) the training of skilled men for fruit tree work.

133 – **The Pollination of Fruit Trees in relation to Productiveness and Planting.** HOOPER, C. H. in *The Gardener's Chronicle*, Vol. LIV, No. 1406, pp. 393-394; No. 1407, p. 420. London, December 1913.

The writer gives the results of observations conducted at Wye, Kent, over a period of six years on the blossoming of apples, pears, plums and cherries, with the object of determining:

1) The degree of self-sterility or self-fertility.
2) The relative order of flowering of the different varieties.
3) The most productive pollenisers.

Experiments on the conveyance of pollen by wind in the orchard showed that the quantity is insufficient to pollinate even adjacent trees and that insects appear to be the chief transport agents. Further experiments showed that insect visitors of fruit consist of 73 per cent. hive bees, 21 per cent. bumble and other wild bees and 6 per cent. other insects.

134 – ***Citrus ichangensis*, a Promising New Hardy Species of Citrus from S. W. China and Assam.** — SWINGLE, W. T. in *The Journal of Agricultural Research*, Vol. 1, No. 1, pp. 1-14, + figs. 1-7 and 1 plate. Washington, October 10, 1913.

The Ichang lemon (*Citrus ichangensis*) was first collected in south-west China in 1888 by Henry ; it was found again in 1903 by Wilson. Its occurrence in a wild state farther north and at higher altitudes than any other evergreen citrus suggests great possibilities in breeding cold-resistant citrus fruits. The size of its seeds makes it probable that it will produce very vigorous seedlings suitable for stocks for other citrus fruits, while the popularity of its fruit and the high prices it commands at Hankow, suggest that it will be a valuable addition to our list of citrus fruits.

It is distinguished from other members of the genus by its huge, thick seeds, its long, slender leaves, with their very large broadly-winged petioles, often exceeding the blade in area. The writer gives a botanical description of the plant, illustrated by diagrams and plates, and its distribution in China.

135 — **The Pubescent-Fruited Species of *Prunus* of the South-Western States.** — MASON, S. C. in *The Journal of Agricultural Research*, Vol. I, No. 2, pp. 147-177 + figs. 8 + plates 8. — Washington, November 1913.

The writer describes seven species of *Prunus* indigenous to the south-western States, which show closer affinities with some of the Asiatic species than with the wild plums of the country. Their adaptation to fluctuations of heat and cold, severe drought and considerable alkalinity of the soil suggests possibilities to the fruit grower of adaptable stocks for such regions and wider scope for the plant breeder.

Contrary to former belief, these species can be divided into small groups of quite diverse character and affinities.

Genus *Prunus*.

Subgenus *Emplectogradus*.

Four species: *Prunus fasciculata* Gray, *P. minutiflora* Engelm., *P. microphylla* Hems., and *P. Havardii* (Wight), n. comb.

Subgenus *Euprunus*.

Section *Piloprunus* n. sect.

One species: *Prunus texana* Dietr.

Section *Penarmeniaca* n. sect.

Two species: *Prunus Andersonii* Gray and *P. eriogyna* n. sp.

136 – **A New Graft-Hybrid.** — DANIEL, L. in *Comptes-Rendus de l'Académie des Sciences*, Vol. 157, No. 21, pp. 995-997. Paris, November 24, 1913.

The roots of an old pear tree (on quince) gave rise to a sucker in 1912 which developed into an individual exhibiting characters, some of which were intermediate between the two parents while others reproduced those of one parent only but in an intensified degree. The case is the more remarkable as the graft-hybrid did not arise at the point of union of the stock and scion and that another sucker situated nearer to the point of union developed into a pure quince.

137 – **An Economic Study of Acacias.** — SHINN, C. H. in *U. S. Department of Agriculture, Division of Publications, Bulletin* No. 9, pp. 1-38 + 11 plates. Washington, December 5, 1913. FORESTRY.

The writer gives a detailed account of the various species of *Acacia* growing in America, pointing out their suitability for timber, commercial exploitation of bark, tannin and gums, as shade trees, for reclaiming and fixing waste sand, and for fodder. He also gives notes on their propagation, growth and management.

LIVE STOCK AND BREEDING.

138 – **Rinderpest: Further Investigations on Questions Connected with the Economical Production of Antiserum.** — HOLMES, J. D. E. (Imperial Bacteriologist, Muktesar) in *Memoirs of the Department of Agriculture in India, Veterinary Series*, Vol. II, No. 2, pp. 33-80. Calcutta, November 1913. HYGIENE

The production of rinderpest antiserum was previously attended with considerable cost, as the virulent blood used for immunising and hyperimmunising the subjects preparatory to drawing off the antiserum, was obtained from an animal at the height of the malady to which it usually succumbed.

The substitution of buffaloes for hill bulls as virus producers effected a great economy, as the former will survive an attack of rinderpest and not only produce virulent blood while suffering from the malady, but also antiserum when recovered. The writer experimented with hill bulls, which were inoculated with virus and received at the same time a protective dose of

serum, thus contracting the disease in a very mild form. The virulent blood from these animals was then used for hyperimmunising hill cattle, with the result that the serum subsequently produced proved almost as potent as when virus was used which had been taken from hill cattle at the height of an unattenuated attack.

In a second set of experiments the writer contrasted the potency of serum obtained after a natural recovery or an immunising reaction alone, with the potency of serum from hyperimmunised cattle, and found that the two were very nearly equal. He also tested the potency of the 1st, 2nd and 3rd bleedings after hyperimmunisation, and showed that the potency of the serum from hill bulls and buffaloes did not remain up to standard after the 3rd bleeding, while that from the plains cattle fell below after the 2nd bleeding, so that the practice of drawing blood 6 to 12 times from a hyperimmunised animal should be discontinued. Finally, a set of experiments was carried out to determine the minimum dose of virus required to hyperimmunise the bulls; it was found that the usual dose of 10-12 cc. per lb. of body-weight could be reduced to 2.5 cc. per lb. of body-weight for plains cattle and to 3 cc. per lb. of body-weight for hill cattle or buffaloes without decreasing the potency of the serum obtained subsequently, and further that animals will continue to produce serum of the same value if re-infected, even though the volume of virus injected each time remain the same.

ANATOMY AND PHYSIOLOGY

139 – **Experimental Rachitis in Young Animals, the Offspring of Parents Deprived of the Thyroid Gland.** — CLAUDE, H. and ROUILLARD, J. in *Comptes Rendus Hebdomadaires des Séances de la Société de Biologie*, Vol. 75, No. 37, pp. 640-643. Paris, December 26, 1913.

The writers removed the thyroid gland from a male and a female rabbit shortly before pairing them, in order to test the effect of thyroidectomy on the growth of the bones in the offspring. The female dropped eight normally developed rabbits and suckled them for forty days. During the first three weeks the young rabbits grew normally, then four of them died, but their skeletons did not show any apparent deformity. The remaining animals developed well up to the age of about six weeks, when they ceased to grow, their weight remaining stationary; they appeared depressed and sleepy, showing weakness in the limbs and at last impaired digestion, and three of them died between the ages of 7 and 13 weeks. Their skins, like those of the first four that died, did not present any pathological appearance. Their live weight was between one-half and one-third that of the control animals. The fourth rabbit survived and its subsequent development was normal.

The post mortem examination of the three animals revealed important lesions of the skeleton: all three presented very marked deformities of the thorax, the front of which was flattened; the breast-bone was curved and the backbone also. At the articulations of the ribs there were spindle-shaped or irregular nodosities, and the radial, cubital and tibial epiphyses showed increase of volume with very marked lengthening of the connecting cartilage, increase of the chondroid stratum and excessive vascularisation. The short and flat bones contained very much marrow. In all of

the animals the pelvis was much narrowed and in one of them the incisives presented curvatures.

On examining sections of the chondro-costal articulations under the microscope, alterations quite comparable to those occurring in human rachitis were observed and are described by the writer in his paper.

A second litter from the same parents seemed normal at first, but then showed insufficient development and died young, but the lesions of the skeleton were not so characteristic of rachitis.

The writers draw from these observations the conclusion that the rabbits had suffered from typical rachitis and, as the gestation and suckling periods had been normal and the animals had been kept under the most favourable conditions, while the digestive troubles had commenced only shortly before death, they attribute it to the thyroidectomy practised on the parent rabbits.

It is consequently possible that a hereditary thyroid insufficiency may be a cause of rachitis.

140 – **Metabolism during Pregnancy and the Lactation Period.** – DIENES, LUDWIG in *Biochemische Zeitschrift*, Vol. 55, Part 1-2, pp. 124-133. Berlin, September 12, 1913.

A communication of the results of experiments on the metabolism taking place in a bitch during pregnancy and before and after the lactation period. The metabolism appears to decrease slightly in the middle of the term of pregnancy, while it increases considerably during the second half of the time. During lactation, it is much more active than during pregnancy. During the lactation period, the mother and young expend the same amount of energy per surface unit. With the cessation of lactation, the expenditure of energy rapidly decreases again.

141 – **The Digestion of Crude Fibre by Sheep and Pigs.** — ANGERLING, BRETSCH, LÖSCHE and ARNDT in *Die landwirtschaftlichen Versuchstationen*, Vol. 83, Part III—IV, pp. 181-210. Berlin, December 23, 1913.

FEEDS AND FEEDING.

The authors experimented upon two wethers and two improved Meissen pigs, with "digested" straw, young grass and wheat chaff. The "digested" straw was prepared by boiling straw under pressure in an alkaline liquid; it thus contains a less lignified crude fibre. In the wheat chaff the crude fibre was much lignified and permeated by encrusting matter. In this latter respect grass occupied an intermediate position between "digested" straw and chaff.

The arrangement of the experiment and the rations fed daily per head during the experiment are shown in Table I.

The additions of "digested" straw, grass and chaff to the basal ration were made in small quantities at the beginning of each period and only towards the end in the full quantity. This was done in order to accustom the animals gradually to the new food. Each period lasted 11 days and commenced after a preparatory period of several days. Samples of the dung of the animals were collected daily, and examined at the end of the period. The examination of the food and the dung was carried ont according to

TABLE I.

Designation of feeding period	Wethers	Pigs
1. Basal ration . . .	700 grams meadow hay + 100 gms. gluten + 250 gms. starch + 10 gms. salt.	1000 gms. barley groats + 250 gms. fish meal + 10 gms. salt.
2. "Digested" straw.	700 gms. hay + 100 gms. gluten + 250 gms. starch + 10 gms. salt + up to 600 gms. "digested" straw.	1000 gms. barley groats + 250 gms. fish meal + 10 gms. salt + up to 600 gms. "digested" straw.
3. Grass *	350 gms. hay + 50 gms. gluten + 125 gms. starch + 10 gms. salt + up to 1500 gms. grass.	500 gms. barley groats + 100 gms. fish meal + up to 1500 gms. grass.
4. Wheat chaff . . .	700 gms. hay + 100 gms. gluten + 250 gms. starch + 10 gms. salt + up to 250 gms. wheat chaff.	1000 gms. barley groats + 250 gms. fish meal + 10 gms. salt + up to 250 gms. wheat chaff.

* In this period only half the basal ration was fed, as it was feared that without this precaution the pigs would not consume the grass; but this fear was found to be groundless.

TABLE II.

	Dry matter	Organic matter	Crude protein	Nitrogen free extract	Fat	Crude fibre	Pure protein	Ash
	%	%	%	%	%	%	%	%
				"Digested" straw.				
Wethers . .	72.65	73.19	—	72.23	—	77.27	—	55.20
Pigs	101.22	88.85	—	63.75	—	94.81	—	—
				Grass.				
Wethers . .	65.29	69.77	76.85	67.29	66.93	69.49	74.05	37.08
Pigs	49.58	51.86	52.05	52.07	84.35	39.39	47.32	35.02
				Wheat chaff.				
Wethers . .	40.33	46.93	55.56	51.54	—	30.34	47.67	10.86
Pigs	20.53	22.95	—	27.86	—	—	—	12.85

the methods adopted at the Mockern and Hohenheim (Germany) Experiment Stations.

The average digestion coefficients for the three fodders experimented upon are given in Table II.

It will be seen from the above that the pigs digested the crude fibre which was not or only slightly lignified better than the sheep, while the latter were able to utilize better the crude fibre more or less permeated with encrusting matter. The better utilization of the crude fibre of " digested " straw by pigs depends partly upon the fact that with the sheep some of the crude fibre of the basal ration escapes digestion. It can therefore hardly be stated that pigs are superior to ruminants in their power of dissolving pure cellulose.

The pigs digested 39.39 per cent. of the cellulose of grass, but they were not able to attack that of wheat chaff, the reason of this difference being that the incrustations are less readily dissolved in the alimentary canal of pigs than in that of ruminants. The superiority of ruminants as regards the power of dissolving cellulose in young grass and in wheat chaff is very probably due to the finer division obtained by better mastication and to a more intense fermentation of the food in the digestive organs.

Summarizing the results, it may be said that pigs are as capable as ruminants of dissolving pure crude fibre or that containing but little encrusting matter, but lose this power in proportion as the encrustation or lignification of the crude fibre increases.

142 – **The Influence of Butter-fat on Growth.** — OSBORNE, T. B. and MENDEL, L. B. (Connecticut Agr. Exp. Station and Yale Univirsity) in *The Journal of Biological Chemistry*, Vol. XVI, No. 3, pp. 423-437. Baltimore, December 1913.

In previous papers (1) the writers showed that the substitution of unsalted butter for part of the lard in a "protein-free milk" food (consisting of protein, starch, " protein-free milk " or its equivalent, and lard) would cause rats to grow normally even if previous malnutrition had arrested development. In the present investigations pure butter-fat was substituted for butter in order to determine whether it contained the active principle.

The pure butter-fat was isolated from the butter by centrifuging the latter at 45° C. for about an hour. At the end of that time the clear melted fat forming the upper layer in the flask was quite free from all impurities, the aqueous solution containing lactose, etc., and the solid matter present in the butter having collected below. The fat was pipetted off and introduced into the daily rations which were made up as follows :

Protein	18 per cent.
Starch	26 » »
« Protein-free milk »	28 » »
Lard	10 » »
Butter-fat	18 » »

(1) See No. 1171, *B.* Oct. 1913. (*Ed.*).

In every case normal growth was obtained on this diet and rats whose weights were decreasing on a "protein-free milk" food immediately recovered.

As the pure butter fat contains no trace of nitrogen, phosphorus or ash, its efficiency in promoting growth cannot be attributed to the presence of nitrogen or phosphorus containing bodies such as lecithin, phosphatides, etc., nor to inorganic salts. Investigations as to the essential difference between butter-fat and lard are being pursued and include the comparative study of a number of other fats.

143 – **The Nutritive Value of Potato Distiller's Slop and of the Substances from which it is Made.** — VÖLTZ, ZUNTZ, VON DER HEIDE and KLEIN in *Landwirtschaftliche Jahrbücher*, Vol. 46, Part 5, pp. 681-832. Berlin, 1913.

There being no reliable data on the nutritive value of potato distillers' slop in comparison to the substances from which it is derived, the writers started an exhaustive investigation into the subject. Already several experiments have been carried out, some being on the digestibility and fermentation of the food in the digestive organs and the others on the exchanges of gas taking place with this feed. The animals chosen for the former experiments were three wethers, and for the latter a 4-year-old steer.

For the better carrying out of the experiments the writers prepared dried potatoes and dried slop. The materials for the slop consisted of 2420 lbs. potatoes (Walthmann variety) containing 18.5 per cent. of starch, 110 lbs. malt and 0.66 lb. yeast. The mash was allowed to ferment to 1° Balling. The other food was prepared by cooking together to a pulp 2420 lbs. of potatoes (Walthmann) containing 18.5 per cent. of starch, 110 lbs. malt and 0.66 lb. yeast, and drying.

The loss of energy that the materials underwent by being transformed into slop averaged 68.8 per cent., so that the slop contained 31.2 per cent. of the calories of the original materials. On analysis it was found that by the preparation of the slop, about one-third of the amides of the original matter had been transformed into yeast protein.

I. *Experiments on Sheep.*

The experiments on the sheep were arranged as shown in Table I.

By feeding potato starch (as a substitute for the loss of energy caused by fermentation) with slop, the writers wished to ascertain how changes brought about by the preparation of the slop, especially in the nitrogenous nutritive matter, act upon the digestion. The only object of feeding lentils was to determine their nutritive value as a concentrated food. In order to determine which ration caused the greatest feeling of thirst, an account was kept of the quantities of water taken and lost. The dung of the animals was always examined fresh. In order to corroborate the results of the experiments on wethers, the writers undertook some on rats also. All the experiments were preceded by a preparatory period of 6 or 7 days.

The results of the experiments gave the following the average digestive values in the three basal ration periods:

Organic matter	60 %	Crude fibre	67 %
Crude protein	56 »	Nitrogen-free extract . .	59 »
Cude fat	33 »	Calories	56 »

TABLE I.

Sheep No.	Period	Duration of Period. Days	Average consumption of food per day
1	1. Basal ration	8	700 grams hay.
	2. Slop + starch	6	700 gms. hay + 75.46 gms. slop + 198.4 gms. potato starch.
2	1. Basal ration	8	700 gms. hay.
	2. Potatoes + malt + yeast	8	700 gms. hay + 250 (potatoes + malt + hay).
	3. Slop + starch	8	700 gms. hay + 75.46 gms. slop + 198.4 gms. potato starch.
	4. Slop.	8	700 gms. hay + 250 gms. slop.
3	1. Basal ration	7	700 gms. hay.
	2. Potatoes + malt + yeast	8	700 gms. hay + 250 gms. (potatoes + malt + yeast).
	3. Slop.	8	700 gms. hay + 250 gms. slop.
	4. Lentils	8	700 gms. hay + 250 gms. lentils

The physiological utilization value of hay was 45 per cent. and the examination of the dung showed approximately nitrogen equilibrium. The digestive values agree with those previously obtained by the writers. The daily amount of water taken was 1.94 quarts per head and stood to the dry matter consumed as 3.4 : 1.

The two potato + malt + yeast periods compared with the basal ration periods showed a great depression of the percentages of digestion of crude fibre and crude protein. These were respectively 24 per cent. and 14 per cent., and were very probably a consequence of the very low protein content and high soluble carbohydrate content of the ration.

For the mixture: potatoes + malt + yeast, the following digestion values were determined :

Organic matter	69 %	Nitrogen-free org. matter	74 %
Crude protein	20 »	Calories	67 »

The physiological utilization value of the mixture was 65 per cent.; the assimilation of nitrogen by 1000 lbs. live-weight was 26.54 gms. per day. The amount of water taken was 2.49 quarts per head and day and stood to the consumption of dry matter as 3.2 : 1.

The two slop + starch periods showed in comparison to the basal ration periods a lower digestion of the crude protein and crude fibre of the ration: 8.9 and 7.5 per cent. respectively. It follows that the nitrogenous nutritive substances were deeply modified by the preparation of the slop. The digestibility of the crude protein and crude fibre was, however, better here than in the potato + malt + yeast periods, which the writers attribute to the former ration being a better medium for the intestinal flora than the latter.

The digestibility of the mixture slop + starch was the following:

Organic matter	86 %	Nitrogen–free org. matter	91 %
Crude protein	27 »	Calories	83 »

The physiological utilization value of the mixture slop + starch was 70 per cent., and was 5 per cent. higher than that of the mixture potatoes + malt + yeast. The nitrogen assimilation was 35.81 gms. per 1000 lbs. live-weight. The water taken up was 2.29 quarts per head and per day and stood in the ratio of 3 : 1 to the consumption of dry matter.

The two slop periods gave the following digestion values:

Organic matter	84 %	Nitrogen–free organic matter	94 %
Crude protein	61 »	Calories	84 »

For the nitrogen-free extract a digestion value of 114 per cent. was found, which is to be attributed to the nitrogen-free extract of the hay being more digestible when fed with slop than when fed alone. This fact, according to the writers, is less to be attributed to a specific action of the slop than to a better adaptation of the microflora in the alimentary canal consequent upon the preceding feeding with hay.

The physiological utilization of slop was 69 per cent., and the assimilation of nitrogen 29.45 gms. per 1000 lbs. live-weight. The water taken up was 3.42 quarts per head and day and the ratio to the dry substance taken up was as 4.4 : 1.

The lentil period gave the following digestion values:

Organic matter	85 %	Crude fibre	52 %
Crude protein	79 »	Nitrogen–free extract	90 »
Crude fat	63 »	Calories	84 »

The physiological utilization value was 62 per cent. and the nitrogen assimilated was 20.13 gms. per 1000 lbs. live-weight per day. The water taken up was 2.91 quarts and the ratio to the dry matter as 3.8 : 1.

These digestion values agree nearly with those of beans.

From the digestion experiments on rats the conclusion may be drawn that the digestibility of the material for the preparation of slop is not inferior to the slop plus an isodynamic amount of potato starch to replace the loss by fermentation. The digestion values for lentils obtained by the experiment on rats were approximately the same as those obtained with sheep.

The writers draw from these experiments the following conclusions :

1. The slop causes a greater sense of thirst than the materials from which it is prepared; this is chiefly due to its high content of potash salts. It is, however, possible that slop contains specific thirst-exciting substances.

The addition of common salt as well as the dilution and neutralization of slop is not to be recommended. It should besides be fed warm rather than cold.

2. The nitrogenous nutritive matter of slop seems, notwithstanding its high protein content, to possess no higher nutritive effect than the nitrogenous foods rich in amides from which it is derived. From this it may be concluded that the amides of the feeds are to be included among the nitrogenous nutriments as well as proteins.

3. The digestibility of slop is considerably greater than has been hitherto generally accepted. Kellner set the digestibility of crude protein in slop at 50 per cent. and that of the organic matter at 58 per cent., while the experiments of the writers give the above values at 61 and 84 per cent. respectively. If the slop and the material from which it is derived are calculated according to Kellner's values for starch and digestible crude protein, their value works out to 1*s* 9*d* per cwt. for the material and to 7 ¼*d* per cwt. for the amount of slop made out of 1 cwt. of the same material. The cash value of the slop would thus be about one-third that of the material whence it was derived. But it has been shown that, chiefly through a low protein content of the ration, only 20 per cent. of the crude protein and 74 per cent. of the nitrogen-free organic matter of the material are digested, while with feeds richer in protein, 51 per cent. of the protein of potatoes and up to 90 per cent. of the nitrogen-free organic matter are digestible. If now these latter figures are introduced into the calculations instead of the former, the value of the material would be 2*s* 1.58*d* per cwt. instead of 1*s* 9*d*. In this case the value of the slop would only be about one-quarter of that of the material from which it was made. It is thus seen that the ratio of value between the material and the resulting slop has a considerable range, and that it depends to a great extent upon the composition of the ration. The writers cannot endorse the generally accepted opinion that the starch value of a food under varying conditions of feeding corresponds to the same nutritive value.

II. Experiments with a steer.

The experiments made with a steer were arranged as follows :

Period	Daily consumption of food
1. Basal ration	17.6 lbs. of hay
2. Potatoes + malt + yeast	15.4 lbs. of hay + 5.5 (potatoes + malt + yeast).
3. Slop + starch	15.4 lbs.of hay + 754.6 gms. slop + 1.984 gms. starch
4. Slop	15.4 lbs of hay + 5.34 lbs. of slop.

Each experiment lasted 16 days and was commenced after a preparatory period of 8 days. On the first and last day of each period the animal was kept in a Regnault Reiset's respiratory calorimeter. The most important results of these experiments, which are to be continued, may be summarized as follows: In the utilization of the rations no great differences were observed between the steer and the sheep. The nutritive matter was digested somewhat better by the steer, while the additions to the hay were better utilized by the sheep. From the respiratory experiments it was seen that the most insignificant changes in the composition of the food influenced the fermentation process in the paunch and consequently the results of the feeding. Also the quantity of the aromatic compounds that passed into the urine varied with the composition of the food. The writers conclude from this that the starch value of a food calculated according to Kellner can differ very much from the one found by a respitatory experiment. The quantity of carbonic acid evolved by the fermentation process in the intestines amounted often to upwards of one-third of all the carbonic acid emitted by the animal, from which it may be inferred that the determination of the quantity of carbonic acid alone is no sure test of the metabolism of ruminants.

BREEDING

144 — **Colour Inheritance in the Horse** (1). — WENTWORTH, E. N. (Ames, Iowa) in *Zeitschrift für Induktive Abstammungs- und Vererbungslehre*, Vol. II, No. 1-2. pp. 10-17. Berlin, November 1913.

Microscopic examination and simple chemical tests show that only two pigments are concerned in the coat colour of horses: 1) red pigment distinct from the yellow ground pigment present in all coloured hairs, and 2) black pigment, which masks the red colour. Quantitative differences occur with regard to the amount of pigment present, thus producing the dilute colours.

The writer suggests a new scheme of factors (see below) which differs from that of most modern investigators in not attempting to arrange all the colours as an epistatic and hypostatic series of simple factors.

C = red pigment or yellow basic pigment.
H = black pigment.
B = a restriction factor, producing bay in presence of H.
G = grey pattern.
R = roan pattern.
D = dappling factor.
S = white blaze on forehead and white legs.
P = piebald and skewbald markings.
M = creamy yellow mane and tail.
I = dilution factor.

According to this scheme: *Chestnut* should contain C and might in some cases also contain B and M; *black* contains C H and may have D in some cases; *mouse* contains C H I, with the possible addition of D; *dun* contains

(1) See No. 1355, *B.* Dec. 1913. (*Ed.*).

CI, CBI, or C M I ; *bay* contains CHB ; *brown* contains CHBD ; *gray* contains CHGD or possibly CGD ; *blue roan* contains CHR ; and *red roan* contains CR or CHBR.

The writer discusses the scheme in reference to all available records — viz: Sturtevant's, Wilson's and Anderson's tables, together with his own personal observations.

145 — **A Cross involving Four Pairs of Mendelian Characters in Mice.** — LITTLE, C. C. and PHILLIPS, J. C. in *The American Naturalist*, Vol. XLVII, No. 564, pp. 760-762. Lancaster, Pa., December 1913.

The writers state that the experiments recorded in the above article were planned as a control to more detailed investigations being carried out at the Bussey Institution. The four pairs of characters in question were as follows :

A = agouti,	a = non agouti.
B = black,	b = no black (brown).
D = density,	d = diluteness.
P = dark eye,	p = pink eye.

A wild grey mouse of the gametic formula $A\ B\ D\ P$ was crossed with a pink-eyed dilute brown mouse of the formula $a\ b\ d\ p$. The F_1 generation all resembled the wild parent and were mated *inter se*, producing 1180 F_2 individuals. These split up into 16 different groups and gave numbers in good accord with the expected.

Both when each allelomorphic pair is considered separately and when the results are taken as a whole, animals possessing dominant characters show a slight excess over the expected numbers, but this is not sufficient to support any theory of coupling, and may be due to selective elimination, as the first observations were made when the mice were already four weeks old.

146 – **Heredity and Regeneration of the Testis in Birds.** — BOND, C. J. in *Journal of Genetics*, Vol. 3, No. 2, pp. 131-139, plates IV and V, figs. 1-9. Cambridge, September 1913.

The writer performed orchectomy on fowls and pigeons and observed regeneration of the gamete-bearing tissue. Experiments were then carried out to ascertain whether the gametes which are formed in this regenerated tissue resemble in their hereditary characters the gametes which are formed by the original gland before removal. In these experiments birds of known genetic composition were used and the cocks were mated with the same hens throughout the experiments.

The offspring of a Brown Leghorn cockerel were of the same type before and after castration. Those of a male Blue Chequer Fantail pigeon were identical in plumage, but among the young hatched before castration none showed any feathers on the toes, whereas out of the 17 hatched after regeneration of the testis 4 showed signs of feathered tarsi. A male Black-and-White Fantail pigeon mated with an Almond-and-White sister produced before castration, 10 young, of which only one was white. After castration and regeneration of the testes the same pair produced 34 young pigeons of which 7 were white.

It would therefore appear that the Leghorn cockerel was homozygous in respect of colour, that is to say that only one kind of gamete was being produced before castration. There is no reason then to expect that the increased production of spermatozoa during regeneration of the testes would result in the production of gametes of a different kind. On the other hand it seems likely that in a sex gland where gametes of different factorial composition are being produced, the temporarily arrested and subsequently increased cell division might result in a different rate or order of production of the different kinds of gametes being formed in that particular organ.

The writer suggests further experiments on the removal and regeneration of the sexual glands of fowls of both sexes which are known to be producing gametes of two kinds only. With confirmation of his results, he considers that a detailed study of the changes in cell division during regeneration of the sperm mother-cells may throw much light on certain results in breeding which seem to be inconsistent with Mendelian expectation. Many apparent anomalies may owe their existence to some change in the rate of reproduction of gametes of different kinds in that particular sex gland.

147 – **On the Zygotic Constitution of Dominant and Recessive Whites in the Silkworm, *Bombyx mori* L.** — TOYAMA, K. and MORI, S. in *Zeitschrift für Induktive Abstammungs- und Vererbungslehre*, Vol. 10, No. 3, pp. 232-241. Berlin, July 1914.

Earlier researches of one of the writers (1) led him to conclude that there must be two kinds of white silkworms, one dominant and the other recessive to coloured breeds. In order to investigate the matter further, a cross was made in the spring of 1911 between females of the Japanese divoltine white (Yamato-nishiki) and males of the European white (sina blanc), both of them being white cocooners sometimes faintly shaded with greenish yellow, and breeding true to type. Nine matings gave 2 344 cocoons, all white but showing a variation of shading up to light greenish yellow like the parents. This F_1 generation was divided into nine classes according to shading, and moths derived from each class were paired *inter se*. The F_2 generation consisted of 17 661 individuals, and in every class whites and yellows appeared in the ratio of 13 white to 3 yellow. These results indicate that two pairs of Mendelian characters are involved, *viz.* *Ss* presence and absence of a colour-inhibiting factor, and *Yy* presence and absence of yellow colour, and that the parents were *SSyy* and *ssyy* respectively.

The writers point out that with this scheme five different kinds of white individuals may be obtained, indistinguishable by their outward appearance, *viz.* *SSYY*, *SSyy*, *ssyy*, *SSYy*, *Ssyy*, and that this may account for the rather conflicting results previously obtained in certain silkworm crosses.

(1) TOYAMA, K. On the varying dominance of certain white breeds of the silkworm, *Bombyx mori* L. — *Zeitschr f. induktive Abst- u. Vererbungslehre*, Vol. 7, 1912.

ID. On certain characteristics of the silkworm which are apparently non-Mendelian. — *Biolog. Centralblatt*, Vol. 32, 1912.

148 – **Non Disjunction of the Sex Chromosomes of *Drosophila*.** — BRIDGES, C. B. (Columbia University), in *The Journal of Experimental Zoology*, Vol. 5, No. 4, pp.587-605. Philadelphia, November 1913.

During the course of his breeding experiments on *Drosophila*, the writer repeatedly met with a certain kind of exception to the ordinary rules of sex-limited inheritance, which led him to conclude that with some female parents non-disjunction occurred in a certain percentage of the maturations, *i. e.* ova were formed which contained two sex-chromosomes instead of the normal one, while other corresponding ova contained no sex-chromosome. He discusses the application of partial sex-limited inheritance to these cases and shows that the hypothesis does not fit his results.

149 – **Comparative Digestion Experiments on Equidae.** — FRANK, O. in *Kühn-Archiv*, Vol. 3, Half - vol. 2, pp. 363-396. Berlin, 1913.

HORSES, ASSES AND MULES

The writer conducted a series of digestion experiments, at the beginning of the year 1913, at the Agricultural Institute of the University of Halle a. H., with the object of ascertaining whether a different power of utilizing food existed in horses, asses and their hybrids. The animals used were a gelding and a mare, a jack and a female ass, two mules (a gelding and a female) and two hinnies (a gelding and a female).

The mare was of the Mongolian breed, while the gelding possessed much Belgian blood. The writer purposely selected two distant breeds of horses in order to ascertain incidentally how the extreme country and improved breeds behaved as to the utilization of food. The other groups could be considered as nearly uniform.

In order to simplify matters, the food used consisted only of hay and oats, and they were fed mixed. Their chemical composition was the following :

	Dry matter	Nitrogen	Crude protein	Crude fat	Crude fibre	Nitrogen free extract	Ash
	%	%	%	%	%	%	%
Hay	84.28	1.20	7.50	1.49	28.76	40.24	6.29
Oats	86.255	2.015	12.59	3.535	10.805	56.675	2.65

The daily rations at first were 10 lbs. hay and 10 lbs. oats per 1000 lbs. live-weight. It soon appeared, however, that this was too much and only so much was given to each animal as it could eat. Water was provided *ad lib.* Each experiment lasted 10 days and was preceded by a preparatory period of 7 days. During the 10 days the excrement of each of the animals was collected and one-thousandth of it weighed and examined. The animals were kept in a stable which allowed of a perfect collection of the excre-

ment. In the determination of the nutritive matter the following methods were followed:

Dry matter: by difference in the esiccator.
Ash: by ignition.
Nitrogen and crude protein: by Kjeldahl's method.
Crude fat: by Soxhlet's »
Crude fibre: by Holdefleiss' »
Nitrogen-free extract: Indirectly by difference.

The digestion coefficients for the several animals are given in the following table.

	Dry matter	Crude protein	Crude fat	Crude fibre	Ash	Nitrogen-free extract
	%	%	%	%	%	%
Jack	63.04	65.01	39.35	39.56	34.32	76.10
She ass	67.53	66.41	49.09	49.05	20.42	80.25
Hinny gelding	71.72	73.50	51.12	46.53	37.90	85.54
Hinny mare	66.06	66.57	61.79	46.16	32.20	77.42
Gelding	62.32	71.08	34.51	37.82	28.81	74.59
Mare	67.10	70.73	42.39	45.46	31.04	79.79
Mule gelding	64.04	66.47	39.20	43.48	39.71	75.87
Mule mare	63.00	58.87	39.78	49.06	35.53	76.83

From the above it appears that there are notable differences in the utilization of food among the various animals. Among the horses, the mare, belonging to a thrifty country breed, digested the food, with the exception of crude protein, better than the gelding belonging to an exacting breed. The latter was distinguished by a high utilization of crude protein, in which it was surpassed only by the hinny gelding. In the utilization of crude fibre, crude fat and nitrogen-free extract the mules and hinnies were superior to the gelding and inferior to the mare.

The experiment justified the conclusion that thrifty breeds of horses can compete in thriftiness with mules. The statement of Sanson that mules are less exacting than horses, because they can utilize raw protein better, is not borne out by these experiments.

The writer has also calculated how much food each animal took up per unit of surface, and found that the opinion that the smaller the animal, the greater the energy it requires to keep up its vital processes, was confirmed.

150 – **The South Oldenburg Horse and the Economic Conditions of its District.** — BURMESTER, HARALD in *Kühn-Archiv*, Vol. 3, Half — Vol. 2, pp. 397-505. Berlin, 1913.

This work contains exhaustive data on the soil, water, and climate of South Oldenburg, as well as on the density of population, utilization of soil, and conditions of proprietorship and of means of communication. It treats then of the general development of horse breeding from its commencement down to the present time and of the ancestry of the breed itself. In the last section of the work the writer discusses the development of the breed with the aid of measurements carried out on 615 breeding animals.

151 – **Colour in Shorthorn Cattle** (1). — WENTWORTH, E. N. (Ames, Iowa) in *The American Breeders' Magazine*, Vol. IV, No. 4, pp. 202-208. Washington, December 1913. CATTLE

The hypothesis that roan cattle are the simple heterozygotes of a red and white cross has been shown to be only very approximately verified by the breeding records of Shorthorns. The writer suggests that two Mendelian factors are involved instead of one, *viz. Rr*, presence and absence of red pigmentation, and *Pp*, presence and absence of roan "pattern" or arrangement of hairs.

The records of the Iowa State College Herd show that individuals which must have been pure homozygous reds, *RRpp*, and homozygous whites of the constitution *rrPP*, when mated together gave an F_1 generation all roan and an F_2 generation made up of :

36 roan, 11 red, 17 white (9 : 3 : 4 ratio);

while roans, which from their records were apparently of the two types *RRPp* and *Rr PP*, gave the following results :

RRPp	bred *inter se*	gave	10	roan	4 red
RrPP	» »	»	8	»	2 white
RRPp × *RrPP*		»	8	roans	
RRPp × *RrPp*		»	3	»	1 red
RrPP × »		»	4	»	2 white.

The writer then discusses the white markings found on both red and roan animals, and considers that these are quite distinct from the roan "pattern".

According to the above scheme of inheritance, and if reds and red-and-whites are grouped together in one class, then reds mated to reds can never produce roans, and whites to whites can only produce whites.

The writer has gathered breeding records together from various sources and tabulates them, but the latter show serious discrepancies with the expected results. On following up a large number of the discordant cases, however, he has been able to prove that they were wrongly classed in the records, and it therefore seems likely that the other discordant cases may be due to similar errors.

(1) See No. 525, *B.* March 1912. (*Ed.*).

152 – **The Influence of Feeds on the Quantity and Fat and Bacterial Content of Milk.** — LUCAS, J. E. in *L'Industrie Laitière*, Year 38, No. 47, pp. 752-761. Paris, November 23, 1913.

The writer conducted a feeding experiment on 21 cows of equal milk yield, with the object of determining by comparison the influence of moist and dry feeding on the quantity, fat content and bacteria of the milk. Earthnut cake, wet and dry, and mangolds, whole and sliced, were fed. The daily ration, which was the same for all the animals, consisted of 99 lbs. mangolds, 6.6 lbs. chaff, 11 lbs. lucerne hay, 3.3 lbs. maize gluten, 3.3 lbs. earthnut cake and 3.3 lbs. wheat bran.

The experiment was divided into a preparatory and a transition period, then the experiment proper and lastly a closing period, and the cows were divided into three groups.

The cake and mangolds were fed as follows :

Preparatory period : 14 days	Group I » II » III	wet	cake,	sliced	mangolds.
Transition period : 8 days.....	Group I :	wet	cake,	sliced	mangolds.
	» II :	dry	»	whole	»
	» III :	dry	»	sliced	»
Experiment proper : 30 days	Group I :	wet	cake,	sliced	mangolds.
	» II :	dry	»	whole	»
	» III :	dry	»	sliced	»
Closing period : 14 days	Group I » II » III	wet	cake,	sliced	mangolds.

The feeds were weighed daily, separately for each group and at the same time. Immediately after each milking, which also was done at the same time, the milk and fat yield of each cow were determined, and seven times during the whole experiment a sample of milk was taken in the morning and in the evening under aseptic conditions, from each group, and examined as to its content in bacteria. The cows averaged 1100 lbs. in weight and were all kept in the same stable.

The result was that the performance of the three groups did not differ sensibly from each other in milk yield and fat content during the whole experiment.

In the bacterial content no striking difference was observed in the milk of the three groups. It seemed, however, that the moist feeds were somewhat more favourable to the development of the milk flora than the dry feeds.

The writer concludes that with the exception of a slightly higher milk yield from the groups fed on whole mangolds, feeding wet or dry had next to no influence on the quantiy of the milk and on its fat or bacterial content.

153 – **The Zackel Sheep in Bosnia and Herzegovina** (1). — MEHMEDBASIC, MAHMUT in *Mitteilungen der landwirtschaftlichen Lehrkanzeln der K. K. Hochschule für Bodenkultur in Wien*, Vol. 2, Part 2, pp. 307-330. Vienna, November 29, 1913. SHEEP

This paper is a very exhaustive study on the breeding of Zackel sheep in the districts of Gacko, Stolac and Travnik in Bosnia-Herzegovina. It contains data on the natural conditions of production of the land, on the outer conformation of the body and on the skull, on the fleece and on the wool of these sheep, on the manner of breeding them and utilizing them (wool, milk, flesh) and also on the economic importance of the flocks. As an appendix to the paper the writer gives in six tables the measurements of the skeleton and of the wool made on 60 animals. He concludes that there are three breeds of Zackel sheep, the chief exterior distinctions of which are the weight of the horns and the length of the wool. The heaviest horns and the longest wool are found in the Vlasic (Travnik) sheep and the lightest horns and shortest wool in the Stolac flocks, while the Gacko sheep are intermediate. For the improvement of the breeds he recommends selection and pure breeding.

154 – **Pig Fattening Experiments with Manioc Roots** (2). — FRATEUR, J. L. and MOLHAUT, A. in *Laiterie et Élevage*, Year 8, No 11, pp. 81-88. Louvain, November 1913. PIGS

The writers carried out for the Ministry of the Colonies two fattening experiments with manioc in order to test its value as food for pigs.

Experiment I was made on a lot of 5 pigs and Experiment II on two lots of 5 each. The animals of lot 1 were of the local breed. Those of lot 2 were crosses of the local breed and Yorkshires. Lot 3 consisted of pigs of the improved local breed. In lot 1 the pigs were full grown and in the other two lots they were still growing. The rations for lot 1 were composed of manioc and pollards in equal quantities and some mangold slices and meat meal. Lots 2 and 3 were fed manioc and pollards in equal parts and skimmed milk. As much manioc and pollard mixture was fed as the animals could eat. The skimmed milk was given throughout the whole experiment in nearly the same quantity. The animals were fed morning and evening, and the food for each lot was weighed daily.

The Experiment on lot 1 lasted 77 days and on lots 2 and 3, 58 days. The preliminary periods were 28 and 19 days respectively. As the pigs of the last two lots accustomed themselves from the beginning to the new food, the preparatory period was shortened. The pigs of lot 1 up to the 38th day of the experiment were fed manioc as raw meal mixed with the other food, but as their appetite soon diminished the cassava roots were steeped in water for 24 hours and then boiled and mashed to a pulp before being fed. After this change the appetite of this lot kept normal and only diminished gradually towards the close of the experiment. During the experiment they received an average of 4.44 lbs. manioc, 4.44 lbs. pollards, 3.52 lbs. mangolds and 0.40 lb. meat meal.

(1) See Original Article, p. 680, *B.* May 1913. (*Ed.*).
(2) See No. 1173, *B.* Oct. 1913. (*Ed.*).

Lots 2 and 3 were fed manioc reduced to pulp from the beginning; their appetite kept good all the time, only diminishing towards the end. Lot 2 were fed 3.25 lbs. of manioc, 3.25 lbs. of pollards 11 lbs. of skimmed milk per head per day and the pigs of lot 3, 2.70 lbs. of manioc, 2.70 lbs. of pollards and 11 lbs. of skimmed milk.

The results of the experiment were that all the animals were well fattened and some very well. Their flesh was savoury and had good keeping qualities; the fat was white and firm. The daily increases in live weight per head were: in lot 1, 1.303 lbs., in lot 2, 1.478 lbs. and in lot 3, 1.374 lbs.

POULTRY

155 – **Reciprocal Crosses between Reeves' Pheasant and the Common Ring-neck Pheasant Producing Unlike Hybrids.** — PHILLIPS, J. C. in *The American Naturalist*, Vol. XLVII, No. 563, pp. 701-704. Lancaster, Pa., November 1913.

In reciprocal crosses between *Syrmaticus recvesi* and *Phasianus torquatus*, two types of male hybrid were obtained according to the nature of the cross. The appearance of these two types is described.

FISH

156 – **Actinomycosis in Carp.** - PLEHN, M in *Allgemeine Fischerei-Zeitung*, Year 88, No. 24, pp. 624-625. Munich, December 15, 1913.

According to the investigations of the writer, this disease, which was first observed in goldfish, and is due to an *Actinomyces*, also attacks carp (1).

In the latter case, it progresses very slowly and it is some years before the function of the affected organ is hindered. If the fish is but slightly infested, its health does not suffer. In dissecting, macroscopic changes are only visible when the fish is entirely infested by the fungus; the microscope, however, reveals the initial stages of the disease. The parasite usually occurs in the peritonaeum, which, when the disease is far advanced, becomes inflamed and is seen to be thickened. This thickening is due to an abnormal deposit of fat in the peritonaeum. Often a similar fat deposit is also found in the lobes of the liver, and in the membrane covering the kidneys and air-bladder. The accumulation of fat in an organ can proceed so far as to make the fish quite dull and lethargic, and liable to die from the slightest injury. The fungus is probably taken up with vegetable food. The only known method of controlling this disease is the elimination from the breeding stock of all fish which have become abnormally fat upon a moderate diet. The consumption of fish affected by actinomycosis is not attended with any danger to mankind.

FARM ENGINEERING.

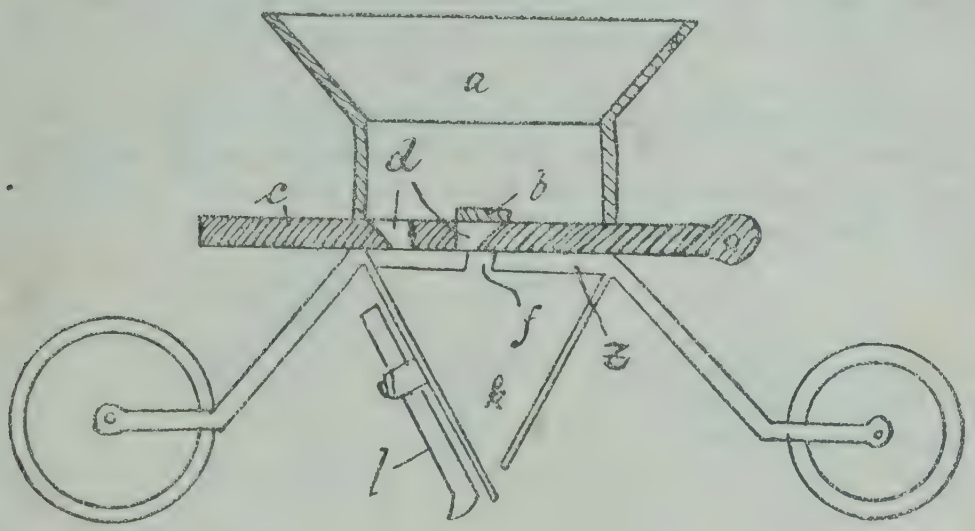
AGRICULTURAL MACHINERY AND IMPLEMENTS

157 – **New Beet-Seed Dibbling Machine (German Patent No. 552 166).** — *Blätter für Zuckerrübenbau*, Year 20, No, 24, p. 387. Berlin, December 31, 1913.

This beet-seed dibble consists of a frame mounted on wheels bearing a seed hopper (*a*) the bottom of which is formed by a plate (*z*) with an aper-

(1) See No. 722, *B.* June 1913. (*Ed*).

ture (*f*) through which the seed falls. At a short distance above this aperture a block (*b*) is situated and between this block and the bottom of the hopper a distributing slide is driven backwards and forwards. In the slide there are two openings (*d*) so arranged that they alternately drop the seeds at certain intervals through a funnel (*k*) into the furrow opened by the adjustable share (*l*).



New beet-seed dibbling machine.

158 – **Trials of Milking Machines in England (1913).** — *Mitteilungen des Verbandes landwirtschaftl. Maschinen Prüfungs-Anstalten*, Year 7, Part 4, pp. 129-153. Berlin, 1913.

In 1913 the Royal Agricultural Society of England organized a competition for milking machines in connection with the Show held at Bristol (1). The trials of the machines took place in April before the opening of the Show: the reports upon them are now printed. They include: 1) The report of the organizers. 2) The judges' report. 3) A report upon the milk samples from a bacteriological and chemical point or view.

The trials, for which the Royal Agricultural Society had offered gold and silver medals and prizes in money, were held at Grange Hill farm, Bishop Auckland, Durham.

The organizers' report contains the conditions of the trials and the special arrangements that had to be made owing to the great number of entries. The judges' report gives some introductory data, followed by short descriptions of the various machines and of the results obtained with them.

The ten following machines were tried:

1. Mjölkningsmaskin Omega, Flen, Sweden.
2. G. Bartram & Son, Melbourne, Australia.
3. Vaccar Ltd., London.
4. Lawrence Kennedy Ltd., Glasgow.

(1) See No. 1064, *B.* Sept. 1913. (*Ed.*).

5. Max Melkmaschinen Ges., Kopenhagen.
6. I. & R. Wallace, Castle Douglas, Scotland.
7. Gane Milking Machine Co., Auckland, New Zealand.
8. Nyeboe & Nissen, Kopenhagen.
9. Jens Nielsen, Kopenhagen.
10 Manus Milking Machine Co., Norrköping, Sweden.

The cows used for the trials, which lasted only six days, had not been milked with machines for two years. They did not suffer any injury from the trials.

The following are some comparative data on the results obtained with the Omega machine (First Prize) and with another competing machine. The two machines were tried on the same four cows. The following data refer only to the morning milking :

	Omega machine	Other machine
Average quantity of milk obtained per cow. . . .	19.35 lbs.	16.54 lbs.
Average strippings per cow	1.13 »	1.37 »
Duration of milking, including time for fitting on apparatus	6.75 min.	10.5 min.

The next are the results obtained with a Vaccar machine (Second Prize) from a notoriously hard milker :

	Vaccar machine	Other machine
Quantity of milk machine-milked	18.19 lbs.	17.94 lbs.
Strippings obtained by machine	2.72 »	5.23 »
Duration of milking	11 min.	13 min.

With the Manus machine the average per cow of the morning and evening milking was 31.5 lbs. and 2.99 lbs. strippings, and the time employed 11 $^3/_8$ minutes.

The Wallace machine is distinguished by its specially complete milking.

The third report deals with the bacteriology and chemistry of the milk samples and includes data on the keeping qualities of the samples and on their bacterial contents.

The report concludes with some hints for the makers of milking machines.

159 – **New Churn** (Austrian Patent No. 59977). — *Wiener Landwirtschaftliche Zeitung*, Year 63, No. 83, p. 944. Vienna, October 15, 1913.

Figs. 1 to 4 show this churn, in which the axis of rotation is at right angles to the axis of the churn itself, and which is provided with a butter-worker. The butter-working apparatus is mounted in a frame which can be put into the churn at right angles to its axis of rotation, so that the cylinders of the butter-worker run parallel to the axis of the churn, which is shown in *c*; *a* is its cover, and *b* the rotating beater. The cylinders of the butter-worker, *e*, are mounted in the frame *d*, which can be slipped

over the counter beaters *f*. The cylinders catch into each other by the geared wheels *h*, and may be worked by the crack handle *g*. As soon as the butter is made and the buttermilk drained off, the churn is so disposed that its axis and consequently the axis of the butter worked are horizontal. On turning the handle *g*, the butter that has fallen on the worker is squeezed through between the cylinders and worked. Then the churn is swung round 180 degrees in the direction shown by the arrow *i*, and the butter which had fallen through the cylinders at the first working and had collected on the side of the churn, is again worked by turning the crank handle in the opposite direction ; this operation can be repeated as often as may be judged necessary.

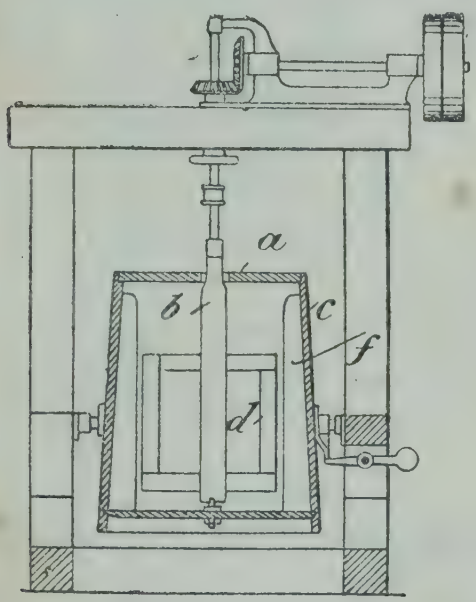


Fig. 1. – Churn during churning (vertical section).

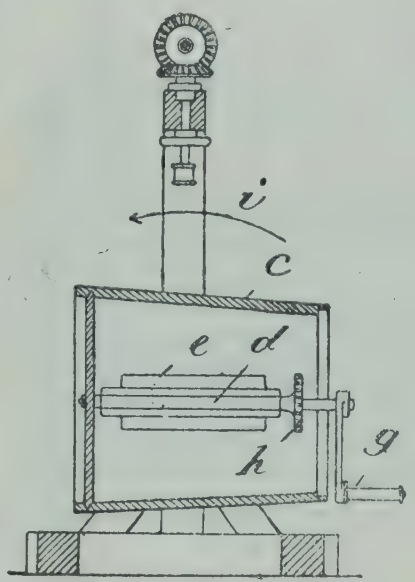


Fig. 2. – Vertical tangential section of churn, showing arrangement of butter-workers.

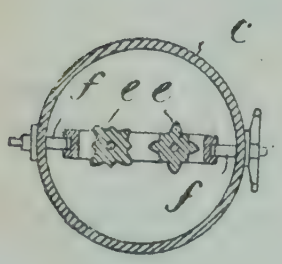


Fig. 3. – Section at right angles to that of fig. 2.

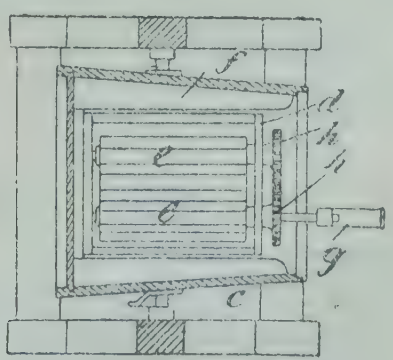
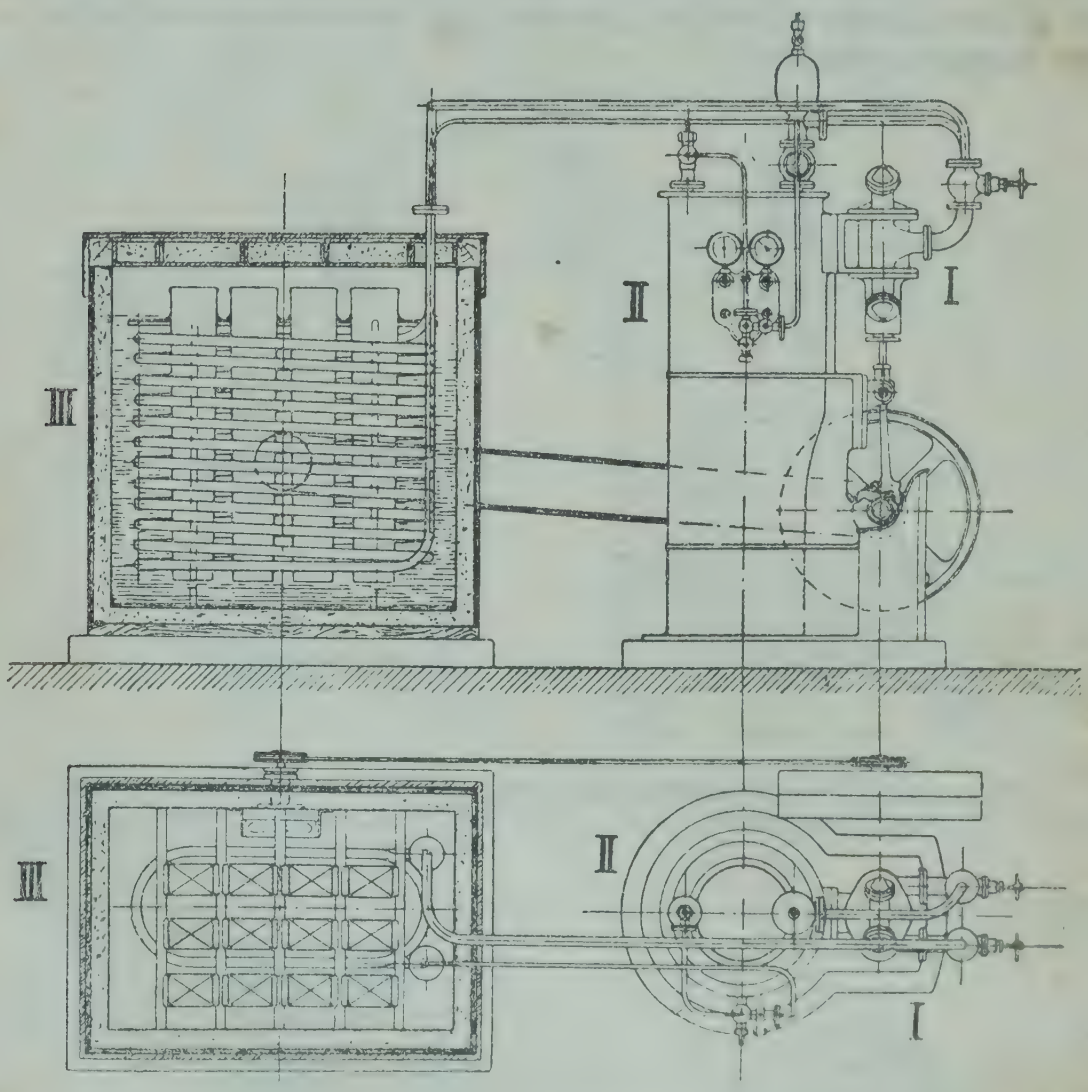


Fig. 4. – Horizontal section of churn.

160 – **Trial of a Refrigerating Installation**. — REZEK, I. in *Mitteilungen åer landwirtschaftlichen Lehrkanzeln der K. K. Hochschule für Bodenkultur in Wien*, Vol. 2, Part 1, pp. 1-16. Vienna, August 25 1913.

The trial of the whole refrigerating plant was carried out between May 12 and 19, inclusive, in the experiment-laboratory of the testing station for agricultural machines and implements of the College of Agriculture in Vienna.

The writer begins by a detailed description of this refrigerating plant and of its working. It is a steam refrigerator using sulphur dioxide and built



Refrigerator. — Elevation and plan.

chiefly for cooling purposes in dairies. The accompanying figures show the chief features of the ice machine, consisting of the compressor (I), the condenser (II) and the evaporator (III), which in this case is built in the ice generator. If the machine is not to be used for making ice, but for direct cooling of milk, the evaporating coil can be converted into a milk cooler over which the milk, without coming into contact with the sulphur dioxide, trickles along the coil containing the evaporating dioxide. Lastly, if the atmosphere of a milk room has to be cooled, the evaporating

coil is converted with a set of mostly cast iron ribbed pipes suspended from the ceiling of the chamber to be cooled.

The price of the refrigerator with ice generator amounts to £216 10s, and with milk cooler to £208.

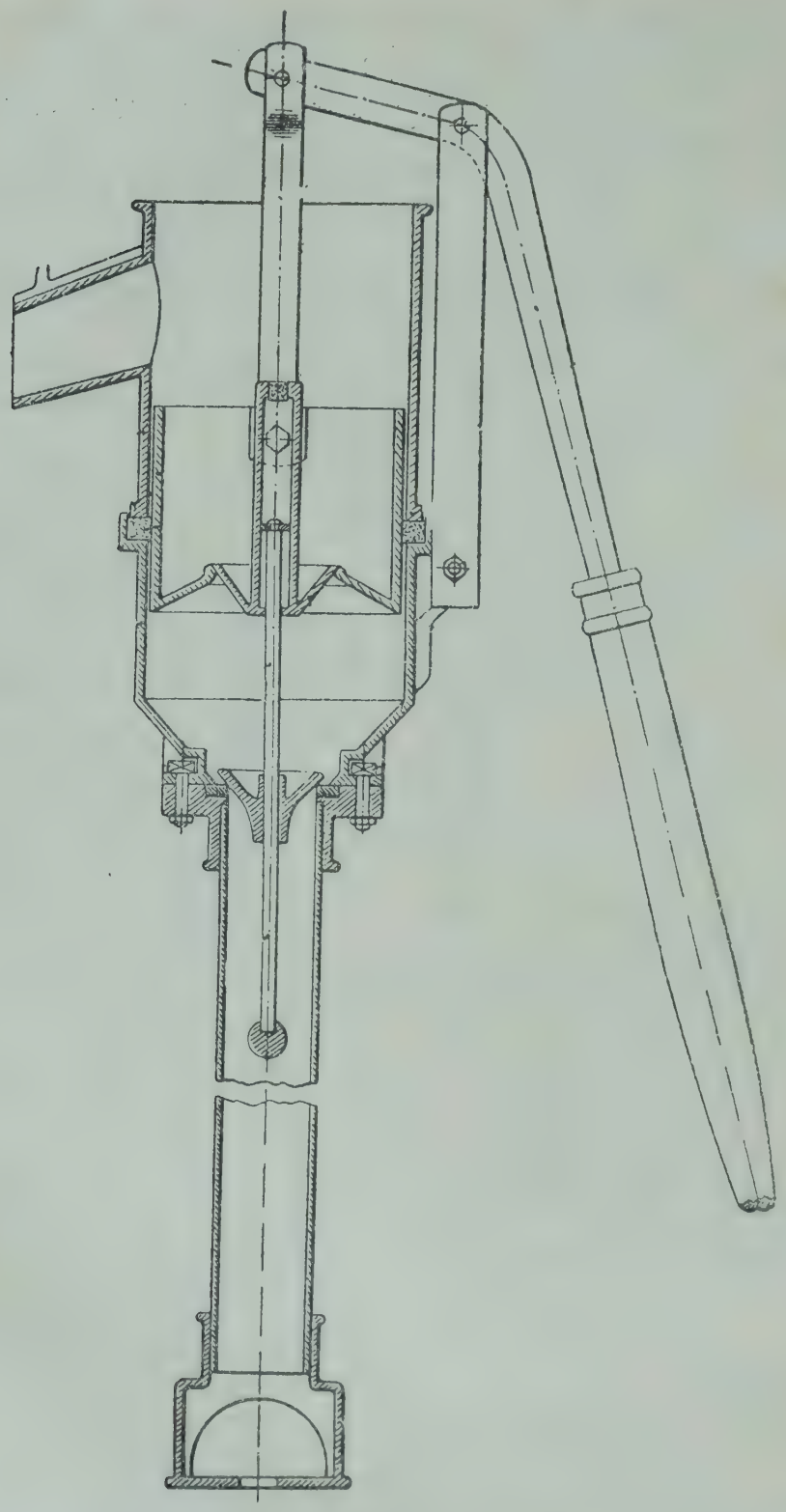
The writer then describes the experiments and their results, which are collected into tables. At first experiments were conducted during which the production of cold by the cooling plant was ascertained by means of brine in the ice generator. Then experiments were made as to its suitability for the production of ice and for the direct cooling of milk.

Lastly the writer illustrates the economic aspect of the above plant by the following table, which contains the most important data resulting from the trial.

Work done	Date	Consumption of power in HP.		Consumption of water for cooling at temperature given in brackets	Performance in calories per hour		
		by machine, including loss by transmission belting	by machine without loss by transmission belting		(a) Total	(b) per HP of motor	(c) per HP transmitted to compressor
				litres			
Cooling of the brine of the ice generator within the limits of — 2° to — 5° C.	12.V.1911	2.57	2.42	881 (10.7°C)	5000	1946	2066
	13.V.1911	2.45	2.36	860 (10.86°C)	5164	2108	2188
Production of ice from water at 12.4° C.	19.V.1911	2.26	2.14	900 (11.45°C)	2891	1277	1350
Cooling of a liquid by trickling over cooler.	12.V.1911	3.61	3.49	866 (10.53°C)	11714	3245	3356
	13.V.1911	3.12	3.03	886 (17.72°C)	9607	3079	3170

161 – **Trial of a Pump for Liquid Manure.** (11th Report of the Station for the Testing of Agricultural Machines and Implements at Hanover). – NACHTWEH, A. in *Mitteilungen des Verbandes landwirtschaftl. Maschinen-Prüfungs-Anstalten*, Year 7, Part 3, pp. 92-98. Berlin, 1913.

In the spring of 1911 one of these pumps for liquid manure was sent to the Hanover Machine-testing Station; since then it has been used on the Gleidingen estate near Hanover and subjected to a long trial of resistance.



Liquid-manure pump. — Vertical section.

The pump, the details of which are protected by patents, is built with the object of combining the greatest simplicity and deviation with the most uniform performance. Thanks to its large valve openings and ample pipes, choking is rendered impossible. The writer gives a detailed description of the pump, the vertical section of which is shown in the accompanying figure.

The writer gives the prices of these pumps according to the heights at which they deliver the liquid and he mentions also a series of portable pumps built on this system and worked by hand or power. The final verdict is to the effect that the pump can be described as useful, practical, and durable. It does not choke and performs its work well for a length of time.

162 – Review of Patents.

Manure Spreaders.

266 808 (Germany). Attachment with distributing wheel applicable to manure carts.
268 908 (Germany). Artificial manure spreader with oscillating hopper bottom.
60796 (Hungary). Manure spreader.
61 775 (Austria). Manure spreader.
255 883 (Belgium). Manure distributor.
460 888 (France). Manure distributor.
62 501 (Switzerland). Liquid manure distributor.

Sowing machines.

268 765 (Germany). Drill.
269 133 (Germany). Furrow-press for drills.
268 077 (Germany). Potato planter with bearing wheels transformed into planting wheels.
268 797 (Germany). Potato planter with hopper and separate funnel shaped receiver into which the potatoes fall and from which they are taken out by a series of clutches.
62 462 (Austria). Potato planter with shear-like clutches on planting wheel.
56 365 (Belgium). Potato planter.
60 745 (Hungary). Combined drill and hoe.
61225 (Hungary). Hand sower.
61 345 (Hungary). Sowing wheel for sowing machines.
61 516 (Hungary). Steering gear for sowing machines.
60 795 (Hungary). Device for emptying the hoppers of drills.
460 569 (France). Device for changing the speed for sowing machines.
16 408 (England). Potato planter.

Mowing and harvesting machines.

62 568 (Austria). Steering gear for vehicles, especially mowers.
61 194 (Hungary). Mower.
255 254 (Belgium). Mower with reaping attachment.
255 998 (Belgium). Improvement in mowers.
1 080 397 (United States). Windrower attachment for mowers.
460 958 (France). Windrower attachment for mowers.
460 998 (France). Reaper with reversible motion.
460 535 (France). Improvement in reapers.
24 872 (England). Harvesting machine.
2074 (Switzerland). Motor mower.
3 035 (Switzerland). Mower.

Root lifters.

68766 (Germany). Beet lifter with clutches consisting of forked levers on revolving disks.
2 071 (Austria). Hand beet lifter.
2 209 (Austria). Potato-lifter.
2260 (Austria). Two-row beet lifter.
2 261 (Austria). Potato lifter.
2 534 (Austria). Beet lifter.

62 860 (Austria). Throw wheel for potato-lifters.
60 571 (Hungary). Potato lifter.
255 501 (Belgium). Potato lifter.
255 456 (Belgium). Beet lifter.
22 685 (England). Potato digger.

Threshing machines.

61 906 (Austria). Thresher with straw press.
62859 (Austria). Attachment for removing chaff and short straw from thresher.
60857 (Hungary). Thresher elevator with guided motion.
255 223 (Belgium). Combined thresher and winnower.
129124 (Italy). Bean thresher.

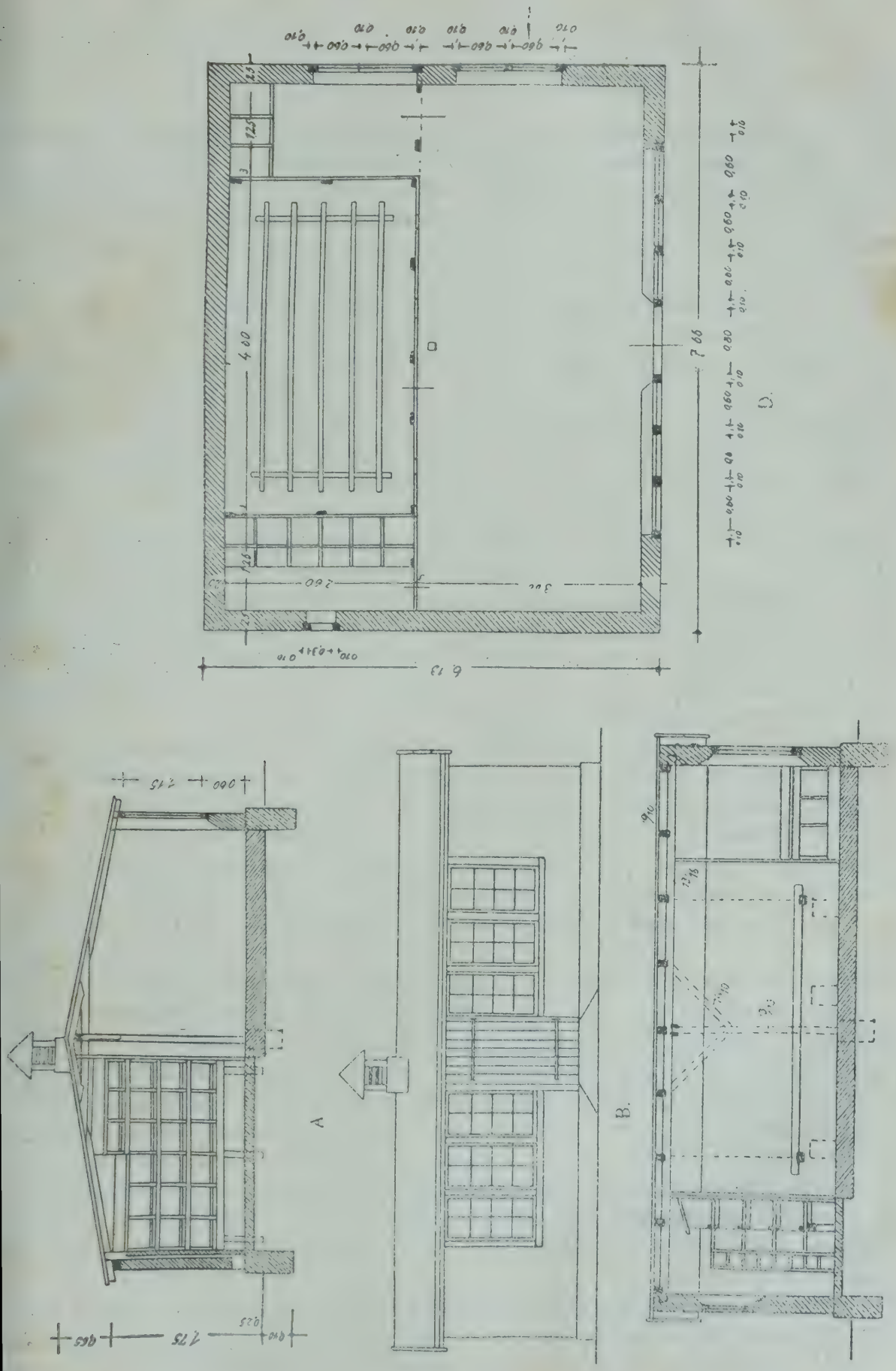
BUILDING CONSTRUCTION.

163 – **Fowl House for 80 or 100 Fowls.** — *Beilage zur Illustrierten Landwirtschaftlichen Zeitung*, Year 33, No. 98, pp. 220-221. Berlin, December 6, 1913.

The annexed figures show the details of a fowl house for a hundred head of small poultry or eighty of larger birds. This fowl house was designed by the Chamber of Agriculture of the Duchy of Oldenburg and cost between £ 28 and £ 36. The outer walls are of reinforced clay (1), and the roof of ruberoid.

The entrance is on the south side; it leads into the day-quarters of the poultry, which occupy moer than half of the total space of the building; the rest is taken up by a large roosting space and by two smaller rooms for the laying and sitting hens, containing also nests and brood boxes. The nests are placed in rows above each other and are easily reached by ladders. The brood boxes are on a level with the ground and adjoin a part of the floor set apart for the chickens. The average height of the building is about 6 feet.

(1) See No. 832, *B.* May 1912. (*Ed*).



Fowl house for 80 or 100 birds. — A, Cross section. B. South elevation. C, Long section. D, Plan.

RURAL ECONOMICS.

164 – **Farming on the Share System and Monograph of a Large Estate worked on this System during the period from 1891 to 1910.** — JENNY, E. *Staats- und Sozialwissenschaftliche Forschungen*, Part 171, pp. XVIII + 346 Munich and Leipzig, 1913.

The share system or metayage is a form of farming according to which the landowner provides the metayer with a certain extent of land for him to cultivate (under his direction and control) and receives in exchange a certain proportion of the gross produce. It differs from simple farming with payment of rent in kind, in that the quantity of produce in kind delivered by the cultivator of the land to the owner is not a fixed and absolute quantity, but a fraction of the gross produce, as it is produced by the land itself. On the other hand the metayer farmer must supply all the labour required from the beginning to the end of the cycle of production, for the payment of a part of the produce for some special work can not be called metayage. The writer distinguishes three kinds of metayage : 1) The whole farm metayage ; 2) Plot metayage ; 3) Labour metayage ("corvée" farming). These three varieties have in common the characteristic of metayage, namely the proportional division of the gross produce and consequently of the profits, as well as the risks and losses, between both parties; where they differ is in the greater or lesser completeness and independence of the farmer, in the demands upon the work and initiative of the owner, and in the share of working capital which each puts into the concern.

The share system of farming, which dates back to the most remote times (it was practised in Babylon, India, Egypt, Rome) is at present chiefly found in Italy, France, Russia, Rumania and in the South of the United States of America. The localities most favourable for this system are determined by social, climatic and economic conditions. It seems most suitable : 1) Where the contrasts in the distribution of landed property are more marked and where the lack of a prosperous class of peasants is more complete. 2) Where it is more difficult to secure sufficient good agricultural labour or where a number of very small landowners strongly attached to the locality and not possessing sufficient land for their wants, object to working for wages. 3) Where the products of the farm are mostly consumed in the farm itself. 4) Where on the one hand an extensive agriculture is carried on according to routine and on the other hand certain crops require intense, careful and minute work. 5) Where the inconstancy of the crops from one year to another is greatest.

The writer shows that the metayage contract cannot be considered a contract of partnership or a simple agreement for renting land or hiring labour, but must be recognized as a special form of contract, one *sui generis*.

The first fundamental function of the share system consists in determining and apportioning between the two parties the profits of landed capital and of labour according to what each contributed to production.

The lower the rent value of the land is in comparison to the price of the labour bestowed upon it by the metayer, the smaller will be the portion of the returns due to the proprietor and *vice versa*. The history of metayage shows that the share of the owner varies between one-tenth and one-half, while that of the metayer but rarely sinks below one-half. Of course such an arithmetical fraction does not express exactly the proportion between the ground rent and the value of the labour except in exceptional cases. But there is, moreover, the third factor of production, the working capital, the providing of which is a useful regulator for determining more exactly the relations between the two contracting parties, which are only roughly expressed by the proportional fraction.

In this respect the total or partial providing of live stock, machines and implements, and seeds is especially important in whole-farm metayage, while in plot and labour metayage any rise in the ground rent is compensated advantageously for both parties by a more intense cultivation. Under all circumstances, however, the fundamental principle of metayage must be maintained, namely that the produce is divided in proportion to the rent value and expenses of the owner on the one hand, and to the money value of the labour and expenses of the metayer on the other. Consequently any prestation or due of absolute amount, in money or in kind, as well as any labour not connected with the land under metayege, is to be avoided, for experience has shown that they lead to serious abuse, and to excessive burdens on the peasant, and alter the proportionality of the division of profits.

When it is a question of new expenses (improvements, introduction of new branches of farming, etc.), the division of the gross produce in proportion to the cooperation of the two parties is the only just basis of the settlement. This may be effected by one of the following methods: both parties contribute to the innovation in proportion to their portion of the profits, or by the side of the main accounts a new account is opened for the innovation, or again if the contribution of the two parties is much altered, then the ratio itself of the divisions of the produce may be changed.

Similarly, in the special agreements as to improvements lasting a long time, the distribution of the expenses must be adapted as completely as possible to the ratio of the metayage; with this object, the time estimate for the amortization must be determined as exactly as possible; then the metayer, being rewarded by his part of the profits, will willingly submit to a greater demand upon his labour and will work at the improvements more conscientiously than any hired labourer.

The size of the metayer farms varies very considerably in different countries; in general, however, it is such as to guarantee the living of a family and at the same time to utilize completely all their labour.

The legal duration of the metayer agreement is generally one year; in practice, however, the tacit renewal has converted it into a contract lasting a long time, which is really the most suitable for this form of farming, because metayage must, from its very nature, include a number of chances

of profit so as to attain a reasonably constant average. The second chief function of metayage, which forms the principal justification of its existence, consists in the diminution of the risks of production, thus being a kind of insurance of the producers. It is especially to be noted that each of the parties ensures for himself the most necessary and dearest and often otherwise unattainable factor of production, namely land for the labourer and labour for the landowner, while exposing to the risk of loss only that factor which for him is the cheapest (labour in the case of the labourer and ground rent for the landowner). This advantageous exchange of values, by diminishing the stakes, diminishes the absolute risk for both parties, and besides, by its compensating effect from year to year, is one of the best means for counteracting the effects of bad seasons, of crises due to falls in prices, of changes in labour and wage conditions and also, frequently, of political disturbances. Consequently the yield of agricultural products is much better ensured by the metayage system than by any other, and this both from the labourer's and the landowner's point of view, as well as from that of national economy.

The eminent economic and social effects of metayage are undoubted. By equalizing the yields, it affords a solid basis to agricultural production, which is often of a risky nature, and it mitigates or removes altogether the serious consequences of a defective distribution of landed property (such as the reduction of the rural population to the state of a proletariat of day labourers, the apparition of the middleman and of the usurer with their train of evils, and absenteeism) and helps a diligent population without capital to the possession of land and prosperity; it offers the most favourable solution to the rural labour question and is a stimulus to the harmonious cooperation of the various social classes for the attainment of common aims and ensures in this manner the most beneficial technical, ethical and political results.

History teaches us that metayage is an excellent system for attaching people strongly and rapidly to the soil in new countries. It should thus, according to the writer, prove a good system for home colonization.

In the last chapter of the first part of his work the writer gives as an introduction to the second part, which is a monograph on a large metayer estate in the district of Odessa, an exhaustive review of the metayer system in Russia. He shows that metayage had to extend greatly in that country in consequence of the juridical development of the conditions of land ownership there obtaining, and that it had to take the special character of plot and labour metayage. The peasants were bound to the land, but did not possess enough of it to supply their wants or to utilize economically all their labour, so that they were forced to rent some fields (need or hunger rents, Not- Nahrungs- Hungerpacht); this led to insupportable conditions of usury and oppression. Such a state of things could be improved only by a conscientiously and firmly applied metayage. In fact metayage has in many parts of Russia favourably prepared the way for the new organization of landownership which is being introduced. The writer

calculates that real metayage is practised in European Russia over an area of about 40 500 000 acres.

The estate described by the writer is situated in the South of Russia in the Odessa district, where a decidedly continental climate prevails. It is composed of four farms amounting altogether to 19 573 acres of extraordinarily fertile soil (black earth). Besides these natural conditions, the character of the people, in which a strong love of independence prevails, and their economical position (very small proprietors under the form of "Mir" or village-community) and the unfavourable labour conditions led the way to metayage. Out of the 13000 acres of arable land, about 1900 were rented, 1350 were cultivated by the owner himself and the rest, or 9750 acres, were farmed on the metayer system, which, during the twenty years, changed from plot metayage to labour metayage.

The writer gives the text of an agreement with a metayer. The most remarkable features are the sharp limits set to the obligation of labour (no demand being made beyond the quota of the metayage), and the stress laid upon punctuality and order. A minute description is given of the technique of the metayer farming: distribution of the land to the peasants and conclusion of the agreement, summons of the metayers to work, oversight and control.

During the years 1891 to 1898 the share of the owner was one-third. The cost of cultivating one acre was about 9*s* 7*d*. The value of the rent of the land being between 4*s* 8*d* and 5*s* 6*d* per acre, the metayer received 2 acres of land to cultivate for himself for every acre of land he cultivated for the landowner.

From 1895 the rent of the land rose constantly; at first this increase was compensated by the improvement in the quality of the labour on the owner's fields. But when the rent value rose to 7*s* 10*d* and 8*s* 7*d* per acre, the quota of two-fifths was gradually introduced into the whole estate. The metayer received three acres of land for his use as compensation for working two acres for the landowner.

Metayage is especially adapted to diminish the risk due to the enormous inconstancy of the crops in the South of Russia.

Table I (p. 260) gives an idea of the range of the crops of spring wheat, barley, rye and winter wheat during the years 1891-1910.

Further causes of risks are the great uncertainty as to the effective cost of production, owing to the unsatisfactory condition of wages, the untrustworthiness of hired labourers, especially at harvest time, and the great oscillations in the prices of cereals not only from one year to another, but also in the various seasons and even within the same month. The writer shows how all these risks are considerably diminished by the metayer system, both for the farmer and for the owner, if indeed they are not completely avoided, and he proves by schematic calculations that with metayage almost the same average results are obtained as by cultivating on one's own account, except that with the latter much greater deviations must be borne and thus a much higher risk than with metayer farming, owing to the much more considerable circulation of capital.

TABLE I.

Returns in lbs. per acre.

Year	Spring wheat	Barley	Rye	Winter wheat
1891	147	147	281	—
1892	401	468	535	—
1893	1364	1578	1271	2568
1894	743	1204	810	696
1895	703	1271	1284	1177
1896	77	140	160	—
1897	482	850	334	214
1898	703	1578	796	1217
1899	0	0	0	—
1900	187	294	120	0
1901	589	796	943	783
1902	0	147	281	1097
1903	575	769	736	682
1904	428	508	441	—
1905	401	468	—	—
1906	589	1084	1070	—
1907	482	769	214	174
1908	548	682	321	—
1909	415	743	535	441
1910	294	1084	943	1739
Average of the years 1891-1910	471.79	754.04	599.90	807.33

0 signifies that the crop was sown but not harvested.
— » that owing to the bad weather it could not be sown.

If 5*s* 1*d* per annum with metayage is accepted as the lowest limit of the net income per acre (to defray taxes, interest on mortgages, personal and general expenses) with which the owner can manage without having to put other money into the concern, then 14*s* 10½ *d* more per acre must be added for cultivation and harvest expenses if the owner farms on his own

TABLE II.

Year	Average yield per acre of wheat, barley and rye	Farming by the owner. Deviation of the yield from the minimum	Metayage		Advantages	
			Yield per acre of total area	Deviation of yield from the minimum	of metayage	of farming by owner
	£ s d	£ s d	s d	s d	s d	s d
1891	10 9½	— 9 2¼	4 3¾	— 9¼	8 4¾	—
1892	18 8¼	— 1 3½	7 5½	+ 2 4½	3 8	—
1893	2 0 4	+ 1 0 4¼	16 1½	+ 11 0½	—	9 3¾
1894	1 8 7¼	+ 8 7½	11 5¼	+ 6 4¼	—	2 3¼
1895	1 14 3½	+ 14 3¾	13 8½	+ 8 7½	—	5 8¼
1896	4 4¾	— 15 7	1 9¼	— 3 4	12 3	—
1897	1 3 5¼	+ 3 5½	9 4½	+ 4 3½	9¾	—
1898	1 18 1½	+ 18 1¼	15 3	+ 10 2	—	8 0
1899	0 0	— 19 11¾	0	— 5 1	14 10½	—
1900	8 1	— 11 10¾	3 2¾	— 1 10¼	10 0½	—
1901	1 10 0¾	+ 10 1¼	12 0½	+ 6 11¼	—	3 1¾
1902	5 0¼	— 14 11½	2 0	— 3 1	11 10½	—
1903	1 7 8¾	+ 7 9	11 1	+ 6 0	—	1 9
1904	17 9	— 2 2¾	7 0	+ 2 0	4 2¾	—
1905	17 7	— 2 4	7 0½	+ 1 11½	4 3½	—
1906	1 13 0¼	+ 13 0½	13 2½	+ 8 1¼	—	4 11¼
1907	1 4 11½	+ 5 0	9 11¾	+ 4 10¾	—	1¼
1908	1 9 0¾	+ 9 11	11 11½	+ 6 10½	—	3 0½
1909	1 9 9¾	+ 9 10	11 11¼	+ 6 10	—	3 0
1910	1 11 9½	+ 11 9¾	12 8½	+ 7 7½	—	4 2¼
					£3 10s 5½d	£2 5s 5¾d

account: 5s 1d + 14s 10 ½ d = 19s 11 ½d. Table II shows by how much, in the various years, the actual returns were above or below this minimum level, further by how much in the average of 20 years this minimum has been exceeded by the owner when farming on his own account, and when farming with metayage. Thus the returns of metayage in nine years exceeded

by £ 3 10*s* 5½ *d* those obtained by direct farming, while in eleven years they fell below them by £2 5*s* 5 $^{3}/_{4}$*d*. This is a difference in favour of metayage of £ 1 4*s* 11 $^{3}/_{4}$*d* in 20 years, or a yearly average of 1*s* 3*d*.

The profit and loss account of the estate shows for the twenty years a final profit of £ 27 957 11*s* 2*d* on 12 148 acres under metayage, while calculation on the basis of the available figures shows a final loss of £159 17*s* 10*d* for direct farming by the owner. Besides, the latter accounts show that in six years the yearly loss ranged between £ 21 145 and £ 27 468, while in no year did the loss under the metayage system exceeds £ 4546. The results of the comparison between metayage and the paying of rent in cash lead to similar results for the peasant. Though the net profit under the two systems works out nearly the same for the labourer, it must not be overlooked that metayage affords him the possibility of utilizing his labour at a rate that he could not otherwise realize, saving in quite exceptional cases. And even a small surplus of profit under the renting system is never a sufficient insurance against the dangers of the renting system under given conditions. With metayage both parties divide the profit and the eventual losses, while one insures the other to a certain extent, so that a final favourable result is certain for both.

165 – **Situation and Problems of Live Stock Breeding and Keeping in Modern Intensive Agriculture.** – MOMMSEN, CHRISTIAN. – *Arbeiten der Deutschen Gesellschaft für Züchtungskunde*, Part 17, pp. VI + 145 and 5 Maps. Hanover, 1913.

With the increasing intensity of farming, which has passed successively from simple grazing to improved rotations with constantly increasing use of chemical manures and of hoed crops, the estimation in which live stock keeping and breeding were held sank; it only began to rise again when the greater prosperity of the population caused an increase in the prices of animal products. The extent to which live stock is kept is to a certain extent dependent upon the conditions of the market and of prices, and this to a much greater degree for pigs and sheep than for horses and cattle, as the latter animals are often kept for purely farming considerations (teams, production of manure, utilization of by-products).

From a comparison between the statistical data on the numbers of live stock and the harvest results in Prussia and in the province of Saxony, it appears that the changes in the numbers are not explained by the results of the harvest in the corresponding year and that more probably there is very little connection between the two facts. It is not one abundant harvest alone, but a series of them, that leads to considerable increase in stock. There is no doubt that prices have a greater influence than harvests in this connection, and this is especially seen in the case of pigs, while since 1907 the increase in the numbers of cattle has stopped, in spite of the tendency of the prices of cattle to rise. Evidently other determining factors are here at work.

The extent to which stock is kept is in the main determined by the lowest harvests. In a certain sense here also the law of minima obtains. That such is the case, is also proved by the fact that live stock keeping and breeding, not including sheep, is lowest in those parts of Saxony in which

the highest average harvests are obtained, where absolutely and relatively the greatest quantities of forage exist : in the districts with the most intensive agriculture, where sugar-beet growing is largely practised. Large estates are partly responsible for this evil. Another cause is the prevailing tendency to give too much prominence to the theory and practice of high class breeding, while at the present time it is the breeding of stock destined to satisfy the wants of the population that is required.

Further, stock breeding is neglected by farmers on account of the ever increasing demands of intensive agriculture; it thus becomes less and less profitable and people get accustomed to consider it *a priori* as an unprofitable branch of farming. The means to remedy this state of things are: a better education of farmers in stock breeding, the technical and social improvement of workers in this field, the increase of special employees for stock breeding so as to get a more scientific management of this branch of farming, and the demonstration of the organic connection between stock breeding and intensive farming.

In consequence of the increased intensity of farming, the production of fodder has increased also and especially such as can be sold only with difficulty or not at all, as is the case with the by-products of hoed crops. In order to utilize them they are fed unsystematically and in too large quantities to the small number of animals, thus not only wasting much food, which represents a loss, but also injuring the health of the animals (which the writer investigates and demonstrates) and in this manner still further diminishing the profits on the stock. In order to diminish the loss, the number of head kept is still further reduced, the feeding in its turn gets more unsuitable and the results are always worse. It is not realized that a vicious circle is here followed and that the conditions of these farmers are such as to require rather an increase of their live stock, obtained by breeding the animals themselves, and that only thus will they be able to utilize fully their masses of fodder. The writer gives some examples of feeds, with the calculation of their cost, for the systematic breeding of heifers, bulls and heavy draught horses.

He then shows that pasturing is necessary for rearing young animals and that also in the interior of the country profitable pastures may be laid down. The manurial conditions of the farm are improved by turning a portion of the arable land into pasture, and keeping young animals at pasture allows live stock to be kept during the winter. Without considering the invaluable advantages for the health of the animals obtained by grazing and which are of special importance for the beet farms, pasturing is in itself profitable when it is suitably managed. The writer gives some practical hints on grazing and warns against overstocking.

The profits of stock keeping depend less upon the breed of the animals kept, than upon the way of keeping them and the object aimed at. Especially in farms with intensive hoed crops, better results would be obtained if less prominence were give to the production of milk and if fattening were combined with rearing young animals on pastures. The keeping of horses also would turn out much cheaper if breeding were practised and the

work done by brood mares and young horses instead of with expensive purchased geldings.

The widely spread opinion that live stock keeping is *a priori* unprofitable is false ; it becomes so by the way in which it is managed in the present system of intensive farming. The valuation given in the accounts to the fodder and to the manure produced in the farm itself contributes also to cause stock keeping to appear unprofitable. According to the writer the only proper way of fixing the price of such fodders is by considering their practical feeding value, the crop returns and also their cost of production, and not one only of these factors to the exclusion of the others.

In no case, however, should live-stock keeping be debited with these fodders at a price which is only exceptionally paid for a small portion of them and which cannot be realized for unlimited quantities.

166 – **Intermediate Valuation of "not Marketable" Produce of the Farm in Agricultural Book-keeping.** – BUDE, ALBERT in *Archiv für exakte Wirtschaftsforschung*, 11 Complementary Part, pp. 101-164. Jena, 1913.

After some introductory remarks on the systems of book-keeping adopted in farms, and on the general theoretical and practical bases of valuation, the writer discusses the valuation of the forage produced in the farm itself and either not marketable or only so to a limited extent, in its connection with agricultural book-keeping. He proposes to replace the more general expression " money value " by "intermediate value" (Zwischenbewertung), because it should indicate the transitory value that this fodder possesses at its delivery from the fields to the productive stock and not its final food (or total agricultural) value.

The introduction of different intermediate values exerts no influence on the total net returns of the farm, but it can cause great differences to appear in the profitableness of the various branches of the farm ; what is required is to determine such intermediate values for these products as represent rightly the relation of the field crops and productive stock to each other and to the whole farm.

With the help of tables containing data taken from practical farming, the writer discusses the intermediate values of the above fodders from a physiological and economic point of view.

In drawing up an accurate estimate of the feeding requirements according to Kellner's rules, those commercial foods are chosen which with the least expense bring up the less concentrated foods of the farm itself to the normal ration required by the system of utilization that has been adopted. In so doing the value of the protein (according to Ehrenberg), which changes for every farm and from year to year, must be considered, and deduction must be made of the manurial value of the commercial foods.

Only those unmarketable products which are effectively consumed by the productive live stock are to be included in the intermediate valuation ; those that are sold directly on the market or those still on hand at the end of the year for sale or consumption in the farm itself must be excluded from the account.

In the feeding estimate, the price on the spot per lb. of starch-value in the mixture of commercial food necessary for systematic feeding (not only in the cheapest concentrated food) forms the basis of prices for the valuation of the unmarketable produce of the farm.

The starch-values contained in the foods of different concentration cannot be considered as equivalent, and have to be valued differently in such fodders produced in the farm. The measure of this lesser value of the less concentrated farm foods is given by the super-concentration of the purchased concentrateds, which are rendered necessary precisely by the lesser value of the former. By super-concentration is meant the excess of protein and starch-values contained in the purchased concentrateds over the average concentration of the rations fed by the farm. The food produced in the farm itself must thus pay the cost of this super-concentration; that is to say the price of these foods must be diminished by the amount of the expense caused by the purchase of the excess of concentration delivered at the farm.

The distribution of the value to be deducted among the various foods produced in the farm is then made according to the algebraic sum of the excess and deficiency of their content in protein and starch-value compared with that of the average total concentration required.

The greater yield due to the farm manure and expressed in money cannot be considered simply as the productive value or money value of the manure. The total amount of the cost with the total gross yield of the manured and unmanured land should be compared in order to determine the final value of the manure. But the account of the productive live stock must not be credited, nor the crop account debited, with anything but an intermediate value for the manure also.

The numerical calculation of the intermediate value can only be made on the basis of a comparative money valuation. Considering the exceedingly variable composition of farmyard manure, its intermediate value cannot be determined on its content of fertilizing substances; the effect of the factors determining its value must instead be taken as a basis and the effect produced by farmyard manure must be compared with the corresponding effect of artificials and the cost (= intermediate value) of farmyard manure be inferred from the cost of mineral fertilizers. This is obtained by the following equations:

I. The cost of mineral fertilizers which give the greatest returns (a) stands to the net returns produced by them (b) as the unknown intermediate value of the farmyard manure (x) is to the unknown relative net returns produced by the latter (y), or:

$$a : b = x : y.$$

II. Money value (intermediate value) of the manure (x) + net return produced by it (y) = Value of farmyard manure (c), or:

$$x + y = c.$$

In this method of valuation all the principal factors which exert a decisive influence on the money value of farmyard manure are considered:

1. Influence of the soil's need of farmyard manure ; 2. Increase of yield due to manure ; 3. Comparison of the effect of farmyard manure with that of chemical fertilizers; 4. Influence of the economic situation. It follows, however, that this intermediate valuation can only be made exactly for one given farm and on the basis of manuring experiments made in that particular farm. If the first two factors determining the value of farmyard manure be called physiological factors, the two latter form the economic factors. This method of intermediate valuation is thus also founded on a physiological and economic basis.

In order to carry out the practical valuation of farmyard manure, the writer used as a basis two field experiments on light and heavy soils taken from the work of B. SCHULTZ of Breslau " Effect and money value of farmyard manure according to eight field experiments each lasting four years ", and he collects in several tables the average results of this calculation and probable oscillations.

167 – **Cause of Difference of Income in Two Pure-bred Dairy Cattle Farms.** — OTIS, D. H. in *Hoard's Dairyman*, Vol. XLVI, No. 12, pp. 319 and 329-530. Fort Atkinson, Wisconsin, October 17, 1913.

The writer compares carefully with the aid of tables two dairy cattle farms situated in favourable positions as to means of communication. They are respectively 400 and 160 acres in extent and the smaller of the two yields a managerial income $3 380.62 higher than that of the other.

The following table shows the principal data of the inner economy of the two farms:

	Farm I	Farm II
Total area	400 acres	160 acres
Arable land	101 »	103 »
Total capital	$ 56 289.50	$ 49 190.10
Fixed capital (amount und percentage of total)	$ 41 600	$ 22 800
	73.9%	46.4%
Working capital (amount and percentage of total)	$ 14 689	$ 26 390
	26.1%	53.6%
Investment in cattle	$ 4 990	$ 21 550
Number of head	61	67
Total receipts	$ 8 750.90	$ 13 811.74
Live stock products sold	$ 3 030.00	$ 3 337.99
Live stock sold and increased inventory of live stock	$ 3 476.50	$ 7 390.25
Sale and increased inventory per cattle unit	$ 18.22	$ 126.08
Total running expenses	$ 4 234.77	$ 4 196.90
Expenses for labour	$ 2 270.40	$ 1 639.60
Printing and advertising	$ 11.00	$ 245.00
Interest, 5%, on capital	$ 2 814.47	$ 2 459.50
Total expenses	$ 7 899.24	$ 9 579.46
Net results (managerial income)	$ 851.66	$ 4 232.28

The extent of arable land is very nearly equal in the two farms, while the running expenses are nearly the same.

The total expenses are even greater by $1680.22 on the smaller than on the larger farm. Consequently the great difference in the net results can only be caused by the difference in the receipts; it comes chiefly from the sale of cattle and from the difference in the increase of inventory. The writer is of opinion that the higher managerial income of the smaller farm is almost entirely due to more judicious breeding, selecting, testing and advertizing.

168 – **Sugar-Beet Farming in Austria-Hungary.** – SEDLMAYR, E. C. in *Mitteilungen der landwirtschaftlichen Lehrkanzeln der K. K. Hochschule für Bodenkultur in Wien*, Vol. II, Part 2, pp. 245-305. Vienna, November 29, 1913.

The writer describes the conditions of farming (exclusive of the conditions of capital and profitableness) of ten large farms which grow sugar-beets in Austria-Hungary. In only one case was the extent of the farm below 500 acres and in two cases it was above 2500. The data given are the result of an enquiry and they embrace: conditions of climate and soil, means of communication, labour and wages; size of property and extent of the various crops; farming proper, rotation, manuring, tillage, yield of crops; live stock: draught animals (cost of a day's work of a horse and of an ox), productive animals (milking, fattening and breeding); dead stock; book-keeping; accessory industries.

169 — **Cost of Rearing a Calf.** — CLAUSEN in *Landwirtschaftliches Wochenblatt für Schleswig-Holstein*, Year 63, No. 44, pp. 883-884. Kiel, October 31, 1913.

The writer gives a summary of the cost of rearing a calf on the basis of the quantities of food administered and corresponding in nutritive content to Kellner's rules for feeding. The cost of attendance, rent of stable, insurance, and interest of working capital on the one hand, and the value of the manure on the other hand, are not included in the account. The whole milk is valued at 6.41 *d* per gal., and the skimmed milk at 1.6*d* per gal. Concentrated foods and hay are taken at the market price.

The weekly costs of food rise at first on account of the increasing quantity of whole milk given. In the fifth week a part of the whole milk is replaced by skimmed milk, in the seventh week whole milk is completely stopped, and in its place meal, crushed linseed and oats are fed.

The cost of rearing a six-months-old calf amounts to £ 6 14*s* 3*d* inclusive of initial cost. With a live-weight of 385 lbs., the cost per cwt. works out to £ 1 19*s*.

	Cost of food	Initial value and cost of food		Cost of food	Initial value and cost of food
	£ s d	£ s d		£ s d	£ s d
At birth.	—	1 19 2½	14 weeks		4 15 7¼
1 week.	4 1½	2 3 4	15 »		4 18 7½
2 weeks	5 5¾	2 8 9¾	16 »	together 18 1¼	5 1 7¾
3 »	6 2	2 14 11¾	17 »		5 4 8
4 »	7 3¾	3 2 3½	18 »		5 7 8¼
5 »	5 10	3 8 1½	19 »		5 10 8¾
6 »	4 3	3 12 4½	20 »		5 14 0¾
7 »	2 8¼	3 15 0¾	21 »		5 17 5
8 »	2 9¼	3 17 10½	22 »		6 0 9½
9 »		4 0 9½	23 »	together 1 3 6¼	6 4 1¾
10 »		4 3 9	24 »		6 7 6
11 »	together 14 9	4 6 8¾	25 »		6 10 10½
12 »		4 9 8	26 »		6 14 3
13 »		4 12 7½			

170 – **Observations on the Practice and Profitableness of Bee-keeping in Switzerland in 1912.** – Report of the Swiss Peasants' Secretariat, in *Schweizerische Bienenzeitung*, Year XXXVI, No. 12, pp. 459-466. Aarau, December 1913.

This paper is based upon the accurate book-keeping of twenty-five Swiss bee-keepers with an average of 25.5 hives each. The total capital invested in each undertaking is £99 3*s* 6*d*, or £3 17*s* 10*d* per hive. The average expenditure of time per undertaking is 149 hours, or 5h. 50 m. per hive. The gross returns in cash are made up as follows :

	Per bee-keeper £ s d	Per hive £ s d	Percentage —
Honey	14 3 4	11 2	72.65
Swarms	4 4 2	3 3	21.45
Comb, etc. . . .	1 3 0	11	5.90
Total . . .	19 10 6	15 4	100.00

The expenses and cost of production are the following :

	Per bee-keeper £ s d	Per hive £ s d	Percentage —
Sugar	6 3 10	4 10½	28.96
Small implements . .	13 6	6	3.15
Expense for hives . .	19 10	9	4.55
» for bee houses	18 3	8½	4.18
Sundries	1 14 11	1 4½	8.23
Work of bee-keeper . .	5 18 3	4 8	27.64
Total outlay . . .	16 8 7	12 10½	76.71
5% interest on capital	4 19 2	3 11	23.29
Total cost of production	21 7 9	16 9½	100.00

If the returns for swarms, comb, etc., are deducted from the general cost of production, the remainder is the cost of production of the honey. It amounts to £16 0*s* 7*d* per bee-keeper, or 12*s* 7*d* per hive ; with an average production of 312 lbs. of honey, this makes 1*s* 0 ¼*d* per lb.

With an outlay of £16 8*s* 7*d* and gross returns amounting to £19 10*s* 6*d*, the net returns are £3 1*s* 11*d* per keeper, or 2*s* 5*d* per hive, which is equal to 3.1 per cent. on the capital invested. The average income of the beekeeper is thus (labour plus net returns) £9 0*s* 2*d* per keeper or 7*s* 0 ³/₄*d* per hive.

171 – **Foundation of a Land Valuation Office by the Swiss Peasants' Association.** — *Schweizerischc Landwirtschajtliche Zeitschrift*, Year XLI, Part 52, p. 1247. Zürich, December 24, 1913.

The Swiss Peasants' Association founded a land valuation office on January 1 of this year at Brugg, with the following programme :

1. Preparing valuations for private persons, for credit institutions and for the State.

2. Assisting in carrying out official valuation : *a*) by preparing opinions on the average values in the various localities, by grouping the soils into classes, by drawing up score cards for individual valuations and undertaking the latter; *b*) by conducting courses on the subject.

3. Carrying out scientific work in agricultural appraisement under the direction of the president of the Swiss Peasants' Secretariat and in connection with the section for the research on profitableness, as, for instance: *a*) preparing the basis for real estate valuation in Switzerland ; *b*) drawing up tables to facilitate the appraisement of land ; *c*) preparing and collecting the systems of valuation of special groups of agricultural capitals (fruit trees, forest trees, vineyards, dead stock, improvements, buildings and the like); *d*) critical elaboration of official regulations on appraising; *e*) discussion of recent publications in land valuation literature.

172 – **Institution of an Agricultural Book-keeping Office at the German Section of the Council of Agriculture for the Kingdom of Bohemia.** — *Land- und Forstwirtschaftliche Mitteilungen*, Year 15, No. 23, p. 257. Prague, December 1, 1913.

According to the resolution of October 25, 1913, a division for agricultural book-keeping and farming advisorship was instituted at the German Section of the Council of Agriculture for the Kingdom of Bohemia; this will soon commence work.

173 – **Association for Obtaining Probatory Power for Agricultural Book-keeping and for Furthering the Science of Farm Management.** (1) BURG. — Report of the Transactions of the First Meetiug on February 18, 1913. Part 1, pp. 26. — (2). HOWARD. — Report upon the Origin and Development of our Endeavours up to the Present. Part 2, pp. 18. Berlin, 1913.

The above Association, wihch commenced its existence with the meeting of February 18, 1913, in Berlin, proposes :

1. To secure for the book-keeping of farmers the same probatory power as that already recognized by law as being possessed by the books of other professions.

2. To afford the followers of the various systems of book-keeping a place in which to express their views and to come to mutual understanding.

3. To promote the study of the science of farm management.

4. To awaken in the members of other professions a better understanding of the conditions of existence of farming, and thus to diminish the existing conflict of interests between town and country.

The Association has its seat in Berlin and holds yearly one ordinary general meeting. The two publications hitherto issued by the Association contain precise data on the preliminaries and the circumstances of its foundation, the means to be used for the attainment of its objects and its statutes.

AGRICULTURAL INDUSTRIES.

DAIRYING.

174 – **Influence of Pasteurizing on the Fat Globules of Cream. Preliminary Research.** – HAGLUND E. in *Nordisk Mijeritidning*, p. 485. 1913.

According to the researches of M. Barthel (*Milch Zeitung*, 1904, p. 490) the well-known fact that separating becomes less complete after preliminary pasteurization depends upon the fact that the fat globules get broken by the rapid movement of the milk during pasteurization. It is therefore essential for the economy of the dairy not to allow the agitator to work more than is strictly necessary. Similarly the widespread opinion that pasteurized cream gives a buttermilk richer in fat than that yielded by non-pasteurized cream leads to the belief that pasteurization has the same effect on cream as on milk, but on the other hand the tendency of the butter globules to agglomerate at a high temperature renders a contrary effect of pasteurization possible.

The writer, chief of the dairy section of the Central Agricultural Experiment Institute in Sweden, submitted this problem to a preliminary investigation, which yielded the following result :

Employing Gutzeit's method (1) it has been demonstrated that pasteurization caused a decrease in the number of the fat globules, on an average from 2300 to 1689 per 1 μ^3 of cream; that is to say a certain number of globules had agglomerated to form larger globules. The average volume had increased from 12.95 to 18.93 μ^3, and a classification of the globules according to their size showed that the number of globules of 2.5 μ^3 had kept the same, whilst the number of those of at least 5 μ^3 had increased from 7 to 11 per cent. A comparative examination between cream that had been heated only and cream that had been heated and stirred at the same time, showed that heating alone does not cause the running together of the globules, but that this is facilitated by mechanical agitation.

175 – **Bacterial and Enzymic Changes in Milk and Cream at 0°C.** — PENNINGTON, M. E. and COLLABORATORS. (Food Research Laboratory, U. S. Dep. of Agr. Washington) in *The Journal of Biological Chemistry*, Vol. XVI, No. 3, pp. 331-368. Baltimore, December 1913.

In a previous paper (2) the writers have shown that milk stored at 0 °C. undergoes market proteolysis, and the present investigations were undertaken to determine how far the changes were brought about by bacterial action and how far they were due to enzymes.

Commercial milk and cream were obtained from a dairy certifying to a high grade of purity and four sets of samples were prepared as follows :

1. Sterilized for 30 minutes in an Arnold steam sterilizer on three consecutive days, and then reinfected with organisms precipitated from the raw milk, thus limiting the changes to those brought about by bacterial action alone.

2. Received 0.1 per cent. of formaldehyde to limit the changes to those brought about by enzyme action alone.

3. "Raw" or untreated milk where both the above factors were working in combination.

4. Sterilized, but not reinfected, to serve as a control.

After treatment the milk and cream were maintained for 35 days at constant temperature (0° C.) in a mechanically refrigerated room, and at intervals of a week the different sets were sampled and subjected to chemical, bacteriological, and zymochemical analyses.

The proteolysis of casein, the fermentation of lactose, and the hydrolysis of fats proved to be due to the action of bacteria, while the proteolysis of albumen was the result of enzyme action. The two varieties of oxidase, the two varieties of reductase and the catalase retained their activity in spite of the prolonged exposure to a temperature of 0° C. The guiac oxidase and the aldehyde reductase in milk appeared to be derived from bacteria only, while the other enzymes were probably partly due to the bacteria and partly native to the milk or the cream itself.

(1) *Landw. Jahrbuch der Schweiz*, 1895, p. 539. (*Authors note*).
(2) *The Journal of Biological Chemistry*, Vol. IV, p. 353, 1908.

The bacterial content of the raw and reinfected samples was estimated by plating out and incubating the plates at 37°, 20° and 0°C; the plates incubated at 20° and 0° C. gave larger counts than those incubated at 37° C. Milk after 35 days contained over 300 million bacteria per cc., and cream after 21 days contained 120 million bacteria per cc. Almost invariably *Micrococcus aurantiacus* (Cohn), and *Micrococcus ovalis* (Escherich), which belong to the group of acid-formers, were the predominant organisms of both "raw" and reinfected sterilized milk and cream.

176 – **A New Butyrometer for Determining the Amount of Fat in Cheese.** — NILGES, H. in *Molkerei Zeitung*, Year 27, No. 86, pp. 1665-1666. Hildesheim, November 5, 1913.

This butyrometer, constructed by Dr. A. Hess and put on the market by Wilhelm Vick of Rostock, Germany, consists of a butyrometer having one end open and the other closed, and reduced in the middle to a flat tube which bears the scale. The upper and lower parts contain each 25 cc. and each division of the scale corresponds to 1 per cent. of fat. Half percentages can also easily be read.

The instrument is used as follows: 5 grams of finely grated cheese are put into it and then 10 cc. of sulphuric acid of S. G. 1.41. The lower part of the butyrometer is plunged into boiling water and gently shaken until its contents are dissolved and the liquid has become a uniform mass of a brownish violet colour. Undissolved particles are easily recognised, for they float as yellow dots on the surface of the liquid. When all the cheese is dissolved, which takes place after 8 to 10 minutes, a further 10 cc. of sulphuric acid is added, this time however of S. G. 1.82. The instrument is then cloesd, well shaken and centrifugated for 5 minutes with the closed end towards the axis of the machine. The liquid thus passes from the larger lower space into the upper one and fills a portion of the graduated tube, so that the position of the column of fat that has separated out can be easily regulated by the stopper. The instrument is left for a short time in a water bath at 65 to 70° C. (149 to 158° F.) and then the amount of fat is read off on the scale after having previously set the sharply defined division between the fat and the rest of the liquid against the O of the scale by drawing out or pushing in the stopper; the bottom limit of the meniscus is to be taken.

In using the instrument, attention must be paid to its perfect dryness and to the fine division of the cheese. Soft cheeses can be introduced into the upper part of the butyrometer by a spatula, the acid added, the instrument closed, turned round and the casein dissolved in the upper part; then the second addition of the acid is made and the rest of the test carried out as with the hard cheeses.

The writer made comparative determinations with 12 different cheeses at the Dairy Institute at Güstrow. They showed that the results of this new instrument agree well with those of the analytical method, while Dr. Wendler's new "Sal" method often gives too low values. The differences between this new method and the analytical method ranged from — 0.21 to + 0.45 per cent.

The writer considers this new method as the simplest and most exact hitherto known and very suitable when many determinations have to be made.

177 – **Faulty Milk in Cheese-making: its Detection and Prevalence.** — STEVENSON, W. (West of Scotland College of Agriculture) in *The Journal of the Board of Agriculture*, Vol. XX, No. 9, pp. 772-773. London, December 1913.

In 1912 the cheeses from a well-known farm in Ayrshire, which has a high reputation for the quality of its Cheddar cheese, developed an unpleasant flavour in the later stages of ripening. The cause of this deterioration was investigated by incubating the milk from each cow, separately, at 98° F., for 24 hours. At the end of that time, a firm, close curd free from bubbles and with a pleasant flavour was taken to indicate that the milk was pure, while partial or total dissolving of the curd and the presence of gas showed that the milk had been contaminated either by dung or by inflammatory organisms from the cows' udders. The results of the tests showed that only 66 per cent. of the samples were irreproachable, and other herds similarly tested gave an even lower percentage. In order to use the unsound milk as economically as possible, it was pasteurised at 160° F. before being added to the bulk and by this means cheeses of excellent quality were obtained.

178 – **A New Method of obtaining Milk Serum and its Importance in the Detection of Watered Milk.** — SANFELICI, RICCIARDO in *Rivista Scientifica del latte*, Year 3, Part 5, pp. 65-67. Reggio-Emilia, October 1913.

This method is carried out in the following manner: 6 cc. of pure 50 per cent. tartaric acid are added (without warming) to 300 cc. of milk ; the whole is well mixed, and left standing for 2 minutes until coagulation is complete. The mixture is filtered through a corrugated filter into a measuring cylinder and poured through again until the filtrate comes through clear.

In order to discover whether the milk has been watered, the specific gravity of 60 cc. of the clear filtrate at 15° C. is determined by means of a small Quevenne lactometer (1). If the temperature of the serum is above or below 15° C. the lactometer reading must be corrected as shown in the accompanying table. (The degrees of the lactometer correspond to the thousandths of the excess the S. G. over 1 : thus 29.2° = S. G. 1.0292).

(1) To be obtained from I. Greiner of Munich. (*Ed.*).

Temperature of the serum	Amount to be subtracted from the figure found	Temperature of the serum	Amount to be added to the figure found
deg. C.		deg.C.	
0	1.0	16	0.1
1	1.0	17	0.2
2	1.0	18	0.3
3	1.0	19	0.4
4	0.9	20	0.5
5	0.9	21	0.7
6	0.9	22	0.9
7	0.8	23	1.1
8	0.7	24	1.3
9	0.6	25	1.5
10	0.5	26	1.7
11	0.4	27	1.9
12	0.3	28	2.1
13	0.2	29	2.4
14	0.1	30	2.7
15	0.0		

The specific gravity of the serum of milks from the district of Lodi (Italy), varies only between 1.028 and 1.030, and thus allows the detection of very small amounts of added water.

Out of 100 milks to which the writer added 5 per cent. of water, 90 were detected by this method, while determination of the solids-not-fat and S. G. of the whole milk (in comparison with the minima of the district) gave only 50 and 8 detections respectively.

PLANT DISEASES

GENERAL INFORMATION.

179 – **The Importation of Cotton Seed into Algeria.** — *Bulletin Agricole de l'Algérie et de la Tunisie*, Year 19, No. 18, pp. 374-376. Algiers, 1913.

LEGISLATIVE AND ADMINISTRATIVE MEASURES

In order to complete the decree of the President of the French Republic dated September 2, 1912, fixing the conditions concerning the importation of cotton seed into Algeria, the Governor General of Algeria has ordered under date of Ang. 12, 1913, as follows :

Art. 1. — Cotton seed of whatever source may be imported into Algeria only through the ports of Algiers, Oran and Bône and the post of Ghardimaou.

Such seeds shall be disinfected on their arrival in the colony by the officials of the Phylloxera Service.

Art. 2. — This order shall be carried into effect by the Prefects of Algeria, the Customs Service and the Phylloxera Service, according as each is severally concerned.

BACTERIAL AND FUNGOID DISEASES.

180 – **Chemical Means for the Control of Parasites of Farm Crops.** — Molz, E. in *Fühling's Landwirtschaftlche Zeitung*, Year 62, Part 23, pp. 822-838. Stuttgart, December 1, 1913.

MEANS OF PREVENTION AND CONTROL

A list of the chemical means, known at present, for the control of animal and vegetable parasites of farm crops. The list comprises remedies based on the following substances : copper, sulphur, arsenic, formalin, carbolineum, soap, nicotine, fumigation with prussic acid.

181 – **A Disease of Red Clover.** — Baccarini, P. in *Bullettino della Società Botanica Italiana*, 1913, October-November, No. 7-8, pp. 118-121. Florence, 1913.

BACTERIAL AND FUNGOID DISEASES OF VARIOUS CROPS

Of recent years the crops of red clover (*Trifolium pratense*) in the Val d'Elsa (Tuscany) have been subject to a very serious disease, with the result that many farmers have ceased to grow it. The disease threatens to become more serious owing to its rapid spread beyond its original limits. It

is known amongst the farmers as " incappucciamento ", and is characterised by an excessive tufty growth and almost entire absence of flowering shoots. With repeated mowing, the disease becomes worse, so that in the second year the still vigorous plants take the form of thick tufts or low cushions of dwarf shoots yellowish green in colour ; the new shoots lack vigour and become weaker and die ; they are followed by even more delicate growth, until finally all signs of vilality disappear. The tap-root and side roots with their bacterial nodules appear quite normal.

According to this preliminary report given by the writer, the appearance of the disease, its development and the continual spreading to new areas indicate its infectious nature. Various fungi and insects have been found in the clover, but none of these can be looked upon as a specific cause of the disease. Further, several bacteria have been isolated from the diseased plants, of which one has proved to be pathogenic. Infection experiments with this particular organism have given positive results, but it is still necessary to confirm them and to work out the conditions of infection in the field, and the part played by the insects.

182 – **Wart Disease of Potatoes: *Chrysophlyctis endobiotica (Synchytrium endobioticum)*** (1).. — *Communicated by Prof.* JAKOB ERIKSSON, *Chief of the Phytopathological Section of the Central Agricultural Experiment Institute of Sweden.*

Since the appearance of the potato disease, *Phytophthora infestans* (Mont).de By., in Europe, no new affection of this plant has equalled in gravity the wart disease, caused, as is well known, by *Chrysophlyctis endobiotica* (*Synchytrium endobioticum*, *S. Solani*).

In England wart disease has been the object of extensive investigations and research since 1909. Scientific research has been carried out in order to discover the nature and the conditions of life of the fungus. Practical experiments have been conducted under the direction of the Board of Agriculture. Every year inspectors have been sent into the infected or suspected districts in order to determine the extent of the infection as well as its intensity in the various localities. In several places experiment fields have been instituted with the o ject of ascertaining how far dusting with fungicide powders or mixing them with the soil reduced or prevented the disease, and whether the different varieties of potatoes were all equally affected by the disease.

The researches and experiments made have demonstrated that the disease spreads slowly but steadily ; the contagious matter preserves its virulence in the soil for years, and all the fungicides hitherto tried have proved ineffectual to prevent or diminish the mischief.

By the side of these negative results, it has however been observed that the different varieties of potatoes are very unequally affected by the disease. According to their resistance they may be classed as follows :

(1) See on this subject *B.* Dec. 1910, p. 361 ; No. 610, *B.* Feb. 1911; No. 1007, *B.* March 1911 ; No. 1911, *B.* June 1911 ; No. 3280, *B.* Nov-Dec. 1911 ; Nos. 219, 221 and 241, *B.* Jan. 1912; No. 425, *B.* Feb. 1912 ; No. 976, *B.* June 1912 ; No. 1100, *B.* July 1912 ; No. 182, *B* Feb. 1913; No. 751, *B.* June 1913 ; *B.* July 1913, p. 1006. (*Ed.*).

a) Varieties that are completely or practically immune from the disease: Langworthy, What's Wanted, Golden Wonder, Peacemaker, Sutton's Discovery (St. Malo Kidney).

b) Varieties generally immune from the disease, but liable to it if grown in infected soil: Aberlady Early, Milecross Early, Snowdrop, Southern Queen, Southern Star, Findley's Conquest, Sutton's Abundance, Sutton's Supreme, Sutton's White City, Chiswick Favourite, Dobbie's Favourite, The Crofter, The Provost, Davie's Laird and Schoolmaster.

c) Varieties seriously attacked in infected soil: Puritan, Sharpe's Victor, Express, Epicure, Myatt's Ashleaf, May Queen, Midlothian Early, Ninetyfold, Maryland Queen, Royal Kidney, British. Queen, Radium, Russet Queen, Colleen, Lady Llewellyn, Sutton's Harbinger, Sutton's Centenary, Sutton's Satisfaction, Windsor Castle, Northern Star, Eldorado, Talisman, President, Tyne Kidney, The Scot, The Bruce, King Edward VII, Up-to-date and similar varieties such as Factor, Table Talk and Duchess of Cornwall.

Among the early potatoes the following are recommended: Snowdrop, Conquest and Abundance. The two latter yield an abundant product and are of good quality, but in rainy years they are very liable to *Phytophthora* and to leaf-curl, which render spraying with Bordeaux mixture indispensable. Among the late varieties the following are recommended: The Provost, Davie's Laird, Golden Wonder and Langworthy. If the soil is much infected the two latter are to be preferred.

It must be remarked that this classification is based only on experiments made in England. Our knowledge of several other diseases of plants has taught us that for a given plant resistance to a certain destructive fungus is not always the same, but that it can vary in different countries and according to the latitutes under which it is grown.

In order to determine to what extent the 1 per cent. formalin solution employed in Sweden against black scab (which appeared in the country for the first time in October 1912) (1) was capable of destroying the parasite in the soil, the Experiment Station carried out some special experiments in the summer of 1913 on three small plots, one 1 sq. metre (a little over 1 sq. yd.) and the other two 0.3 sq. m. (3 sq. ft.) in extent. These plots were isolated from the adjoining ground by a cement or zinc partition descending into the soil to a depth of over 3 ft. At the beginning of spring a great number of seriously diseased potatoes were mixed with the soil of the three plots. Somewhat later, about a fortnight before planting, the two small plots were watered with a 1 per cent. formalin solution at the rate of 10 litres per sq. metre (1.8 gals. per sq. yard), whil t the large plot was left unwatered. On May 20 the three plots were planted to potatoes; in one of the small plots two tubers of Magnum Bonum were placed, and in the other two of Up-to-date. This latter variety is recognized in England as being very liable to the disease. In the third and larger plot five tubers of Up-to-date were planted. In the three plots the plants grew vigorously

(1) See *B.* July 1913, p. 1005. (*Ed.*).

during the summer and autumn, presenting the appearance of healthy plants. On September 8 the potatoes were lifted. It was then found that all the tubers gathered from the plots that had been watered with formalin solution, namely 17 tubers of Up-to-date and 13 of Magnum Bonum, were completely free from black scab, whilst out of the 43 tubers lifted from the larger untreated plot, 39 showed characteristic eruptions of the disease. The infection however was not very severe on any of the five plants, owing no doubt to the fact that the contagious matter, having been introduced into the soil only in the spring and not in the preceding autumn, had barely penetrated into the soil.

Anyhow, the above experiment shows that a 1 per cent. formalin solution at the rate of 1.8 gals per sq. yard has the power of destroying the infectious matter in a soil infected by the potato black scab fungus. In dealing with a soil that has been infected for years a stronger solution will be necessary, namely 2 or 3 per cent.

183 – **American Gooseberry Mildew *(Sphaerotheca mors-uvae)* recorded from France.** — FOEX, ETIENNE in *Journal d'Agriculture pratique*, 1913, Vol. II, No. 49, pp. 717-719. Paris, December 4, 1913 : and in *La Revue de Phytopathologie appliquée*, Vol. I, No. 13, pp. 165-167. Paris, December 5, 1913.

The writer records a small outbreak of American gooseberry mildew in the centre of France. He indicates the present distribution of the disease in northern and central Europe and the regulations adopted by some of the countries concerned (1) together with the methods of control at present in use (2).

184 – **The Effect on Carrots and Spinach of being grown in Soil infected by Finger-and-Toe.** — FRON, G. in *Journal d'agriculture pratique*, 1913, Vol. II, No. 49, pp. 730-731. Paris, December 4, 1913.

Several plots of cabbages were partly destroyed in 1912 by *Plasmodiophora Brassicae*. The cabbages were succeeded by a crop of carrots, which only flourished in the parts free from disease. The same effect was noticed in the case of spinach grown under similar conditions. The roots of the carrots were not examined, and no obvious disease was noticed on those of the spinach. They showed, however, certain deformities the cause of which has not yet been determined. Microscopic examination did not reveal the existence of the finger-and-toe fungus in the tissues.

(1) An editorial note in the *Revue de Phytopathologie appliquée* states that in France, where the disease was noticed and studied for the first time in June 1913, the Minister of Agriculture, on the advice of the "Comité consultatif des Epiphyties" has requested the Prefect of the Department of Loiret to issue immediately, by means of a provisional decree, such regulations as may be considered necessary for limiting as far as possible the damage due to the disease.

(2) See No. 1301, *B.* Nov. 1913. [*Ed.*].

185 – **Streak Disease of Sweet Peas.** (1) — *The Gardener's Chronicle*, Vol. LIV, No. 1409, p. 459. London, December 27, 1913.

The National Sweet Pea Society offers a prize of £ 10 10s and the Gold Medal of the Society to the first person furnishing a cure for streak disease of sweet peas. Communications should be addressed to the Secretary, D. Tigwell, Greenford, Middlesex.

186 – ***Ascochyta Gerberae* n. sp., Parasite of *Gerbera Jamesoni*, an Ornamental Composite.** — MAFFEI, LUIGI in *Rivista di Patologia Vegetale*, Year VI, No. 9, 3 pp. Pavia, 1913.

For the last two years the specimens of *Gerbera Jamesoni* possessed by the Botanic Garden at Pavia, and obtained partly from Antibes, have had their leaves damaged by a Spheroidaceous fungus which has spread considerably in 1913. The disease appears as a small nut-coloured circular spot, which gradually increases to some centimetres in diameter. And as on the same leaf several such spots are produced, these run together and almost completely spoil the leaf, which wilts. The spots become dark chestnut in colour and are either sharply defined or their edges shade off into a wine colour; they occupy both sides of the leaf and present concentric streaks. Observing them with a magnifying glass they appear dotted with small prominent bodies, the pycnidia of the fungus, which the writer refers to the genus *Ascochyta* and considers as a new species under the name of *A. Gerberae*.

The writer does not know whether the disease has developed in other localities; anyhow, considering the rapidity with which it spreads, it is advisable, failing practical means of cure, to collect and destroy the leaves that are attacked in order to prevent the spread of the disease on a plant which, though of recent introduction, is already, owing to its flowers, the object of considerable exportation and a not indifferent source of profit to those districts which grow it on a large scale. In Italy also its cultivation has been undertaken, especially in Liguria, where it thrives very well in the open and acquires its full beauty.

PARASITIC AND OTHER INJURIOUS FLOWERING PLANTS.

187 – **A Poisonous Buttercup (*Ranunculus sceleratus* L.) in New South Wales.** — HAMILTON, A. A. in *The Agricultural Gazette of New South Wales*, Vol. 24, Part. 10, p. 862. Sydney, 1913.

Ranunculus scelcratus, described as especially poisonous to cattle, has been found by the writer at Waterloo, N. S. W., in a ditch flowing into Cook's River. It is probably a recent introduction and is not yet very widely spread. There is every prospect, however, of its spreading over a comparatively large area of low-lying marshy land in the neighbourhood of Cook's River, as the plant is a freely-seeding annual and occurs under conditions excep-

(1) See No. 1108, *B.* Sept. 1913. (*Ed.*)

tionally favourable for its propagation. These marshes are much used by local dairymen and horse owners for grazing purposes, especially during the summer months when other pastures are suffering from lack of moisture. As far as is known, it has only once previously been recorded in Australia, *viz.* by Professor Ewart in 1905, near the Snowy River, Victoria.

INSECT PESTS.

MEAAS OF PREVENTION AND CONTROL

188 – **Life-History of Syrphid Fly Predaceous on Froghopper Nymphs.** — GUPPY, P. L. in *Department of Agriculture, Trinidad and Tobago, Special Circular*, No. 8, 5 pp., 3 figs. Trinidad, October 23, 1913.

The writer describes the life-history of a syrphid fly, *Salpingogaster nigra*, which extends over 20 ½ to 21 ½ days. Its larvae attack the nymphs of *Tomaspis saccharina* ("Sugar Cane Froghopper") and *T. pubescens* ("Black Froghopper"). During the larval stage (9 to 10 days) each *Salpingogaster* destroys or sucks from 30 to 40 nymphs of the froghoppers. There is no doubt that this parasite destroys large numbers of very small larvae, wherever the latter are abundant. In two cases the writer found some adult froghoppers which had only just emerged from the nymph stage killed by the larvae of the parasite.

Salpingogaster nigra occurs wherever froghoppers are found. It is one of the most important of the natural enemies of the froghopper. It is its specific parasite, and it is hoped that it may be reared successfully on a large scale.

189 – ***Monolexis lavagnei* n. sp. (Braconidae) parasitic on *Sinoxylon sexdentatum* on Vine Shoots.** — PICARD, F. in *Bulletin de la Société entomologique de France*, 1913, No. 16, pp. 399-402, fig. 1. Paris, 1913.

Sinoxylon sexdentatum Oliv. is a Bostrichid beetle commonly found in the South of France on vine shoots, which it destroys. To the many enemies of this insect already well-known is now added a new species of Braconid, described by the writer as *Monolexis lavagnei*, distinct from *M. foersteri* March. This new Hymenopterous insect is not exclusively parasitic on *S. sexdentatum*; it has been taken from oaks attacked by *Scobicia pustulata* F. and by *Xylonites praeustus* Germ., and also from Corsican pine (*Pinus Salzmanni* Dun. = *P. Laricio* Poir.), attacked by *Pytiogenes* and *Pityophthorus*. The species is probably widely distributed in the South of France

190 – **Parasites of the Fruit Fly** (1) **in Africa.** — SILVESTRI, F. in *Estratto dal Bollettino del Laboratorio di zoologia generale e agraria della R. Scuola superiore di Agricoltura in Portici*, Vol. VIII, pp. 164, LXIX figs., 1 Map. Portici, 1913.

In those regions in which fruit growing is an important branch of agriculture and which possess a climate and soil suitable for its extension, much alarm has been felt, especially during the last ten years, at the spread of the fruit fly, *Ceratitis capitata* Wied (2). Whilst some entomologists sought

(1) See also No. 1404, *B.* Dec. 1913. (*Ed.*).

(2) See *B.* Dec. 1910, p. 375; No. 2028, *B.* June 1911; Nos. 3253 and 3281, *B.* Nov.-Dec. 1911; No. 1692, *B.* Dec. 1912; No. 182. *B.* Feb. 1913. (*Ed.*).

artificial means of control of the injurious insect, others endeavoured to find its parasites and to introduce them into the countries in which they did not yet exist. But the first results obtained were unfavourable and caused many to consider that the natural control of *Ceratitis* and other insects of the same genus and of the genus *Dacus* was impossible. The question was, however, taken up again in 1910, when the discovery of *Ceratitis capitata* in Hawaii (Honolulu), almost certainly introduced the previous year with Australian fruit, placed the serious problem before the islanders and obliged the authorities and entomologists to solve it.

The writer was invited by the Hawaiian Government to proceed to West Africa in order to seek there the parasites of the fruit fly, as that part of the world had not yet been explored from this point of view, while it was considered as the probable home of the insect. Sig. Silvestri's plan was the following: *a*) to ascertain by visiting the greatest number of colonies if *C. capitata*, besides being found in the Congo, existed in western Africa, in Senegal and to the south of that region, and if it was controlled by special enemies which might be advantageously introduced into Hawaii and into Italy (this country also being interested in the question); *b*) should *C. capitata* not be found, but some other allied species or insects of the genus *Dacus*, to seek their parasites and to experiment them on *C. capitata*, and if they held out promise of success to introduce them into Hawaii and Italy.

The writer left Europe on July 25, 1912, and visited the following localities: the Canaries, Dakar, French Guinea, Senegal, Southern Nigeria, Kamerun, the Gold Coast, Dahomey, the Congo, Angola, South Africa, Australia, Honolulu. He returned to Italy, reaching Naples in July 1913.

After some notes on the places he had been at and on the entomological researches carried out in each, the writer enumerates the fruit flies observed during his travels: *C. capitata*, *C. giffardii* Bezzi, *C. silvestrii* Bezzi, *C. stictica* Bezzi var. *antistictica* Bezzi, *C. punctata* Wied., *C. anomae* Graham, *C. colae* n. sp., *C. rubivora* Coquillet, C. *nigerrima* Bezzi, *C. tritea* Walker, *Dacus oleae* Gm., *D. armatus* Fabr., *D. bipartitus* Graham, *D. lounsburyi* Coquillet, *D. vertebratus* Bezzi, *D. brevistylus* Bezzi, *D. longistylus* Wied. The systematic description of these flies is accompanied by information as to their geographical distribution, host plants, life history, and in the case of *C. capitata* and *D. oleae*, as to the injury caused by them, and the artificial and natural means of controlling them.

The writer then gives the systematic description, geographical distribution and life history of the numerous parasites of the species of *Ceratitis* and *Dacus* observed and collected during his journey. They belong to the following families.

a) Braconids: *Opius concolor* Szépl., *O. dacicida* Silv., *O. lounsburyi* n. sp., *O. dexter* n. sp., *O. perproximus* n. sp., *O. perproximus* var. *modestior* n. var., *O. humilis* n. sp., *O. inconsuetus* n. sp., *O. inquirendus* n. sp., *O. africanus* Szépl., *O. africans* var. *orientalis* n. var., *Hedylus giffardii* n. sp., *Diachasma fullawayi* n. sp., *D. fullawayi* var. *robustum* n. var., *D. tryoni* Camer., *Biosteres caudatus* Szépl., *Sigalphus daci* Szépl., *Bracon celer* Szépl..

b) Proctotrupids: *Galesus silvestrii* Kieffer, *G. silvestrii* var. *robustior* n. var., *Trichopria capensis* Kieffer.

c) Chalcids: *Dirhinus giffardii* n. sp., *D. ehrhorni* n. sp., *Spalangia ajra* n. sp., *Tetrastichus giffardii* Silv. (1), *T. oxyurus* n. sp.. To these the writer adds *Syntomosphyrum indicum* Silv. (2), as it is a species which may be very useful, at least in tropical countries, and should be introduced into Hawaii.

d) Formicids: *Dorylus affinis* Schuck, *D.* (*Anomma*) *nigricans* Illig. var. *hybrida* Santschi, *Aeromyrma vorax* Sanstchi.

From the writer's researches the following facts are established.

1) In West Africa various species of *Ceratitis* and *Dacus* exist, some of which, at least in the months in which the writer observed them, were so reduced in numbers as to lead one to believe that they were effectively controlled by natural enemies.

2) A certain number of Braconids (of the genera *Opius, Diachasma, Hedylus, Biosteres*), of Chalcids (of the genera *Tetrastichus, Spalangia*) and of Prctotrupids (of the genus *Galesus*) are perhaps the most active enemies of fruit flies in West Africa, without however excluding other natural enemies, such as insect egg-parasites, bacteria and fungoid parasites of the larvae.

3) In Nigeria and in Dahomey the writer has ascertained the presence of *C. capitata*; it was however, at least from November to February, extremely rare; this is probably due to the same parasites discovered by the writer for the other species of *Ceratitis* and *Dacus*, without however excluding the possible existence of other enemies.

4) Several hymenopterous parasites of any one species may attack different species of *Ceratitis* and *Dacus*.

5) Parasites of *C. giffardii* and *C. anonae* were experimented by the writer with *C. capitata* and they developed well.

6) The writer conveyed to Honolulu living adult specimens of *Opius perproximus, Dirhinus giffardii, Galesus silvestrii* from West Africa, of *O. humilis* and *Trichopria capensis* from South Africa, of *Diachasma tryoni* from East Australia; from Honolulu to Portici, Italy, he brought specimens of *Dirhinus* and of *Galesus*.

7) *Dirhinus giffardii* and *Galesus silvestrii* were multiplied and distributed in large numbers at Honolulu, and *Diachasma tryoni* and *Opinus humilis* in smaller numbers; in Italy, *Dirhinus* and *Galesus* were distributed.

8) Concerning the results of such distributions nothing can be affirmed until the acclimatisation of these species is ascertained; but supposing it to succeed, at least in Hawaii, with *Diachasma, Opius humilis, Dirhinus* and *Galesus*, a considerable destruction of *C. capitata* is to be hoped for.

9) In case *Diachasma tryoni* does not become acclimatized owing to the small number of specimens imported into Hawaii, it will be necessary to import as soon as possible large numbers of them from Aus-

(1) See No. 1404, *B.* Dec. 1913 (*Ed.*).
(2) See p. 375 *B.* Dec. 1910. (*Ed.*).

tralia, the importation of this parasite from Australia to Hawaii being very easy. The introduction of other Braconids of the genera *Diachasma* and *Biosteres*, parasites of *Anastrepha*, from Mexico and Central America, is advisable before again attempting the introduction of Braconids from Africa, because owing to the distance of this country from Hawaii and the nature of the parasites, their arrival in good condition is very difficult, whilst their introduction into Italy from West Africa is easy.

10) It is important, and according to the writer even necessary, to study *C. capitiata* further in West Africa, and to ascertain if it is attacked by *Tetrastichus giffardii* ; if so, attempts should be made to introduce the parasite into Hawaii and Italy.

11) It would also, in the opinion of the writer, be very useful to extend the study of *C. capitata* and other fruit flies in East Africa from Natal to Uganda, because it is possible that other good parasites exist in those regions.

12) He advises also the importation from India into Hawaii of *Syntomosphyrum indicum* and to study the other parasites of the genus *Bactrocera* in India, as among them there might be some very useful for the control of *B.* (*Dacus*) *cucurbitae* and some suitable for *C. capitata*.

13) For the olive fly (*Dacus oleae*) it is necessary in the first place to attempt the introduction and acclimatisation of *Opius concolor* from Tunis, then the parasites that are already known and others that may be discovered in Eritrea ; if these should not afford the desired results, the parasites from South Africa will have to be imported and those which may be discovered in other parts of Africa and in Asia.

14) It is of the greatest importance for Italy to study the olive fly in Tripolitania, where no mischief is reported, and in Eritrea, where many species of parasites of the fly are already known. These researches might perhaps lead to the solution of the grave problem of the control of the fly and would at all events be very useful in extending our knowledge of the life-history of the fly and of its enemies.

The work ends with a rich bibliography.

191 – **Some Factors affecting the Susceptibility of Cucumber Plants to Burning from Hydrocyanic Acid Gas** (1). — STONE, G. E. in *Annual Report of the Massachusetts Agricultural Experiment Station*, Year 25, No. 31, pp. 61-72 + 1 plate. Boston, January 1913.

Experiments on the fumigation of cucumber plants with hydrocyanic acid gas in glass houses of different illumination gave the following results :

(1) See also *B.* Dec. 1910, p. 382. (*Ed.*).

Average of three experiments	Number of compartment				
	1	2	3	4	5
Relative intensity of light * %	24.40	26.60	48.10	74.00	100.00
Average height of plants . . cm	22.30	23.30	17.30	19.90	15.50
Average diameter of stem . »	0.44	0.53	0.53	0.66	0.78
Average length of internodes »	7.30	7.00	5.90	4.30	4.00
Length × width of leaves. sq. cm.	70.90	90.30	62.60	80.20	85.50
Effect of fumigation on leaves **	all burnt or killed	burnt, few killed	some only burnt	traces of burning	no burning

* The relative light intensities were determined by chemical methods. The varying light conditions were obtained by means of cloth screens of various grades from mosquito netting to fine muslin.
** All the plants were fumigated with 0.007 gram of cyanide per cubic foot during 1 hour.

Experiments on the effect of varying quantities of soil moisture on the susceptibility of cucumber plants to burning by hydrocyanic acid gave the following results:

Average of three experiments	Number of pot					
	1	2	3	4	5	6
Percentage of moisture * . . .	10.00	15.00	20.00	50.00	60.00	70.00
Average height. . . . . cm.	6.20	7.50	10.20	13.00	17.50	21.20
Average length of internodes »	4.20	4.50	5.20	5.50	7.50	8.2
Average length of petioles . »	1.30	1.7	2.2	3.20	4.00	3.2
Average diameter of stem. . »	0.30	0.30	0.40	0.45	0.55	0.50
Average length × average width of leaf . . . . sq. cm.	6.25	39.5	67.5	162.50	225.00	285.0
Effect of fumigation on leaves **	no burning	no burning	slight burning	nearly all leaves burnt		

* Percentages of the total water-retaining capacity of the soil, which was 47 per cent.
** Fumigation as before.

These experiments point to the conclusion that differences in the development of the tissues, whether brought about by inferior light conditions

or by excessive moisture in the soil, affect their susceptibility to burning under the influence of hydrocyanic acid.

Further experiments are being conducted to throw more light on the influence of other factors.

192 – ***Tapinostola musculosa*, a Noctuid Moth injurious to Cereals in Hungary.** — JABLONOWSKY, JOZSEF in *Köztelek*, Year 23, No. 99, pp. 3335-3337, figs 441-443. Budapest, December 24, 1913.

In 1913 a good deal of damage was done to crops of oats and barley on the Pusztapó estate in Hungary by the caterpillars of *Tapinostola musculosa* Hb.; some 40 acres were so badly infested that the crops had to be ploughed under.

This species occurs in most of Europe, except the extreme north, and in Central Asia; it was not previously recorded as injurious in Hungary, though in Russia it has been known to do enormous damage in some years, as in 1882, 1894 and 1899, when it was estimated that two-thirds of the crops were destroyed.

The larvae hibernate in the stubble or in rough grass at the edges of the fields, so that these places should be ploughed deeply if possible, or else burnt. Once they reach the grain crops, to which they move about the end of March, the damage cannot be prevented.

193 – ***Anthonomus grandis* var. *thurberieae* (a Cotton-Boll Weevil) on *Thurberia thespesioides*, in Arizona.** – PIERCE, W. DWIGHT, in *Journal of Agricultural Research*, Vol. I, No. 2, pp. 89-98, figs. 1-9, plate VI. Washington, D. C., 1913.

In February, 1913, considerable importance was attached in a preliminary report to the discovery of a Curculionid in Arizona (Ventana Canyon, Santa Catalina Mountains), resembling the Mexican cotton-boll weevil (*Anthonomus grandis* Boh.), whose injurious character is well known. The insect lives in the capsules of *Thurberia thespesioides* A. Gray (*syn. Gossypium Thurberi* Tod. and *Ingenhauzia triloba* Moç et Sesse), a Malvaceous plant indigenous to Mexico and Arizona, and known by the natives as "wild cotton", on account of its resemblance to the true cotton plant.

Examination of abundant material from several localities in Arizona has enabled the writer to distinguish this insect as a new variety of *A. grandis*, which he names var. *thurberiae*; it differs from typical *A. grandis* in several morphological, physiological and biological characters: the nature of its host (*Thurberia thespesioides*), its occurrence at higher altitudes (4000 ft) and the period of its development (mid-August to November). This variety might fly considerable distances in search of food, though it will probably confine itself to its natural host as long as there is sufficient of the plant to supply it with food. Supposing there were a shortage, the insects would naturally attack cotton first, and with disastrous results. Extensive destruction of *Thurberia* is therefore to be deprecated as tending to encourage the insect to adapt itself to the cotton. Thus the writer considers it would be better not to interfere with the present conditions, and suggests the introduction of parasites of *A. grandis* to reduce the numbers of the insect and keep it in check.

194 - ***Acheta morio*, an Orthopterous Insect injurious to Sisal in German East Africa.** — KRANZLIN in *Der Pflanzer*, Year IX, No. 11, pp. 568-570. Daressalam, November 1913.

The writer has observed on a number of year-old plants in certain parts of a plantation of *Agave rigida* var. *sisalana* a new type of damage not previously recorded on this crop. Portions of the lower leaves about an inch long have been eaten away, sometimes at the tip, but more often at the base, just above the junction with the stem. The damage differed from that caused by snails, which eat the upper surface to a slight depth, in consisting of holes cut from the edge of the leaf towards the centre ; in some cases whole pieces of the leaf appeared to have been removed and certain leaves were nearly or quite cut off from the stem.

In places where the surface of the ground contained crevices or clods of earth, hardly a single plant had been spared. The writer, unable to ascertain the cause of the destruction in the day-time, visited the plantation at night and observed a large number of very small young of *Acheta morio* (Orthoptera) on the damaged parts, for which they were obviously responsible.

The localisation of the insect and its damage is explained by the fact that it only finds a suitable retreat during the day-time in places where the surface of the ground forms hiding-places in which it can live under damp conditions even in dry seasons. Such being the case, this insect cannot become a source of serious danger to the cultivation of sisal.

ALFREDO RUGGERI, *Gerente responsabile*.

FIRST PART.

ORIGINAL ARTICLES

Agricultural Education in the Argentine Republic

by

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I. PRESENT ORGANIZATION

Agricultural education in the Argentine Republic may be classified under hree heads: 1. Higher education given in the Universities; 2. Medium, ele- ientary and continuation education provided by the Federal Government; . Agricultural education provided by some of the provinces and by special nstitutions or by national institutions connected with the above or- anization.

Higher university education. — This is given by the faculties of Agricul- ure and Veterinary Science, which form part of the National Universities f La Plata and Buenos Aires. The first of these two faculties was founded n 1813 in the present School of Agriculture and of Animal Husbandry at Santa Catalina ", which is now a practical school of agriculture annexed to he same institute. The second, situated in the neighbourhood of Buenos ires at a place called " La Chacarita ", was founded on September 25, 1904. Both faculties include two sections, one for agricultural engineers, the ther for veterinary surgeons. The programme is a four years' one. For dmission the degree of " bachelor " granted by the National Colleges is equired; failing this the candidates have to pass an examination equivalent o the above courses. The La Chacarita faculty differs from the one at a Plata in that it has organized arrangements for boarding the students hich will be inaugurated in 1914. The teaching staff at La Chacarita is nly to a limited extent composed of agricultural engineers and veterinary urgeons, while at La Plata almost all the professors hold such diplomas.

Both institutions are endowed with laboratories and museums which an compete with the best of the kind, and the cultivated lands and experi- ent fields that surround them are such as to meet all educational re-

quirements connected with the extensive type of agriculture prevailing in Argentina.

Most of the young men who take their degrees at these institutions find immediate employment in the national and provincial services, the requirements of which in this direction are always increasing. Some are engaged as managers of private undertakings and others again manage their own estates.

Secondary elementary and continuation education. — As has already been stated, the vast organization that includes all the institutions of this kind is under the control of the Federal Government, through the Ministry of Agriculture, of which one division called " General Board of Agricultural Education "directs all these services.

The General Board of Agricultural Education was constituted in 1906. It develops an organic scheme of education which includes :

a) — Practical instruction given in the District Practical Schools scattered over almost the whole of the country.

b) — Special or technical instruction given in the Special Schools.

c) — Continuation courses entrusted to local agronomists and other subordinate officials distributed in the most important agricultural and live-stock breeding districts.

d) — Experiment fields and experiment stations attached to the practical and special schools.

e) — District nurseries, devoted to the production and selection of forest and orchard plants and to their distribution in their respective districts.

a) — *Practical schools.* The instruction imparted by these schools and by the special schools is free of charge. It is local, in as much as it is restricted within the limits of the produce of each belt ; it is specialized, as it is directed especially to that branch of agriculture or industry which characterizes the district in which the school is situated. These schools have adopted the system of lodging and boarding their pupils, who live in common with their professors and thus enjoy all the advantages of this system. The following are the eleven schools of Agriculture at present existing in the Argentine Republic :

1. — Dairy school at Bell Ville (Cordova).
2. — Agricultural school at Bella Vista (Correntes).
3. — Pomological school at San Juan.
4. — Subtropical school at Posada (Missiones).
5. — Forestry and industrial crops school at Colonia Benitz (Chaco).
6. — Agricultural school at Las Delicias (Entre Rios).
7. — Agricultural school at Puerta de Diaz (Salta).
8. — Agricultural school " 25th of May " (Buenos Aires).
9. — School of agricultural mechanics at Bahia Blanca.
10. — Market - gardening and fruit - growing school at Tigre (Buenos Aires).
11. — Dairy school at Olavarria (Buenos Aires).

The Tigre, May 25th, and Olavarria schools will be in working order in 1914.

The practical schools do not follow a systematic plan as it is usually understood ; the curriculum is determined by the kind of production that the school will choose during the scholastic year. The practical agricultural schools are organized in the same way as a model private farm and they aim at obtaining the best and most abundant product at the least possible cost and in such a manner as to allow the pupils to have a clear idea of the results obtained by the systematic methods adopted by the school. These practical schools have the object of forming employees capable of carrying out the special work performed in the schools, and the theoretical part of the teaching is limited to pointing out the reasons of the practical processes at the moment in which the latter are applied. The pupils are all boarders ; the courses last three years (six half-years) ; the instruction, board, lodging, clothing, etc., are all free of charge. The school of agricultural mechanics at Bahia Blanca not being provided with the necessary installation for boarders, gives its pupils equivalent allowances in cash.

In order to stimulate the students' activity they are granted a daily remuneration of 10½ *d*, 1*s* 3 ³/₄*d* and 1*s* 9*d* during the first, second and third year respectively; this remuneration may be diminished for bad behaviour or for insufficient application to study (the students must perform all the practical work done in the institution).

Besides, to encourage thriftiness, savings banks have been opened in the practical schools.

At the end of the courses the students get a diploma certifying to their competence in the special branch which they have studied. This diploma however is not available in competitions for public employments because the object of these institutions is to turn out good and capable agriculturists. These schools also try to find situations for their pupils in the district, furnishing all the necessary information and proposing those candidates that seem most suitable for capacity and morality.

The school half-years embrace the periods of the greatest agricultural and industrial activity ; there are two yearly vacations of 15 days each ; the working hours are the same as those adopted in private establishments ; the time spent in the classes does not exceed one hour per day and is used only to take notes and to prepare the calculations and the drawings necessary for the operations of farming and industrial practice.

For admittance to one of these practical schools the following are the requirements : Age : above fifteen (birth certificate). Health and physique suitable to the special work to which the pupil intends to devote himself (medical certificate). Reading and writing correctly and a knowledge of the four fundamental operations of arithmetic. For this, examinations will be held between the 1st and the 6th of January in the school itself or elsewhere according to instructions. Applications are received between the 1st and the 15th of December.

b) *Special or technical schools.* — The special schools are also local ; they not only train their pupils in one given branch of agriculture, but they endeavour to develop in them a commercial spirit by making them assist in all the operations connected with transactions over the produce of the establishments, thus contributing to form their individual judgment. These schools, like the preceding ones, are boarding schools. In the school for vine growing and wine making at Mendoza the boarding system has not yet been adopted on account of the required premises. Not more than 25 pupils are admitted at a time in order to have full efficiency of instruction. The school year begins on March 1 and ends on December 31, with two months vacation.

In order to be admitted to the special schools the following conditions are required : 1) Age, not less than 17 years (certificate of birth or equivalent document) ; 2) Health and physique suitable to the work the pupil will have to perform (medical certificate) ; 3) Certificate of having passed the fifth class of the communal schools or passing an equivalent admission examination.

Free places are granted to Argentine condidates who comply with the above requirements and satisfactorily prove that they are not in a position to meet the necessary expenses.

The pupils are boarders, except at Mendoza ; they may be paying pupils or free of charge. The former pay £ 8 15 *s* per quarter, payments in advance. Those who obtain the free places are boarded, lodged, clothed, etc.

The Mendoza school disposes every year of 25 free places or scholarships of £ 4 7*s* 6*d*, which sum is paid in cash. The other schools grant scholarships in proportion to the merits of the students and to the finances of the institution. The expenses due to those who have free places form part of the general expenses and of the working expenses appropriated in the budget. The scholarships are only granted to Argentine subjects in straitened circumstances and, other conditions being equal, the sons of farmers and people engaged in industry are preferred.

The special schools open at present are the following :

School of vine growing and wine making at Mendoza; School of fruit growing and sugar making at Tucuman; School of agriculture and animal husbandry at Cordova; School of agriculture at Casilda (Santa Fé).

The Casilda school is an intermediate type between the special and the practical school. The pupils who leave it bear the title of farm managers (Administratores Rurales).

The vine-growing school of Mendoza possesses vineyards and a model cellar. It gives the diploma of vine grower and œnologist. The curriculum extends over three years besides a preparatory course.

The courses at the school of agriculture and of animal husbandry at Cordova have the same duration. The students on leaving get the title of experts in agriculture or animal husbandry. They can then follow the higher courses at the National Faculties of Agronomy or Veterinary Science.

At the Tucuman school of pomology and sugar making the courses extend over four years, the first of which is preparatory; then come two years

of general study and one of special study in the sugarcane industry. On leaving, the students get the title of experts in fruit growing and sugar making. In order to increase the practical efficiency of the training, a factory for the extraction of sugar from sugarcane is being erected at the school.

c) Continuation education. — This instruction is imparted by local agronomists. The Republic is divided into twenty districts, to each of which one of these agronomists is appointed. This official has the duty of spreading among the rural population of his district instruction about the crops, for the benefit of the men, women and youths who cannot follow the regular school courses. These local agronomists, assisted sometimes by a subordinate staff, conduct temporary courses, travelling lectures, cooperative experiments, and demonstration trains. The temporary courses are held for the children attending the primary schools, for adults and for soldiers also. During the vacation the schools of agriculture organize short courses on special subjects. .

Several railway companies have placed special trains at the disposal of the district agronomists, who give lectures, information and advice in the above trains, as well as in ordinary trains, in farms and on the premises of agricultural associations.

The cooperative experiments are intended to improve local production ; they extend the field of action of the experiment stations and of the schools of agriculture to those localities which lack such institutions, and assist in verifying and demonstrating the experiments made in them. The experiments conducted by the co-operation of the State with private persons are as numerous as possible in the area entrusted to each district agronomist. They are a happy combination of official and private initiative and fully justify their title, because the State supplies the seeds and the technical management of the experiments, whilst the other party provides the soil, labour and other necessary factors. This organization is completed by the continued and persevering assistance of the General Board of Agricultural Education in all the competitions and shows (national, district and local) which take place in the district, and by the stimulating action of the institutions under the Board on everything connected with the founding and organizing of societies, syndicates and agricultural co-operative associations.

d) and *e) Experiment stations and district nurseries.* — These institutions must also be mentioned for their importance and because they complete the whole system of agricultural education. The experiment stations, which like the experiment fields are attached to the schools, are provided with a special staff which teaches the pupils experimental methods. They are a complement to the schools both from their position and from their administrative dependence : they are in fact placed under the scholastic jurisdiction and employ in their work the same means and the same factors, at the same time that they enjoy a complete scientific independence as to their researches. There exist also other experimental institutions of recent foundation under the Board of Agriculture and Agricultural Defence

(Direccion de Agricultura y Defensa agricola), which forms another division of the Ministry of Agriculture.

The technical experts of agricultural education, considering experimentation as inseparable from tuition, constantly demand unity of action, vindicating their tradition as initiators of experimental research in the country.

Agricultural educationpossesses also some special establishments called district nurseries, devoted to experimentation and more particularly to the multiplication of forest plants. Thanks to these establishments and in proportion to the progress of the buildings, rural organizations and agricultural improvement of the soil, the Board forms gradually a new nucleus suitable to the institution of a new school according to an established plan. Some of these establishments have been placed under the control of the Board of Agriculture and Agricultural Defence.

Such is the national organization of agricultural education under the Ministry of Agriculture. It forms a harmonious whole which renders valuable service to the progress of Argentina and to the unceasing development of the agricultural industries of the country.

II — Complementary organization.

a) *National institutions with agricultural sections.* — In order to complete the review of the national agricultural education, notwithstanding the fact that the principal character of the following institutions is different from that of the schools of agriculture, it is worthy of note that agricultural instruction is imparted in the Reformatory at Marcos Paz (Province of Buenos Aires) under the control of the Ministry of Public Instruction, and that agricultural work is carried out at the lunatic asylum called the Open Door near Lujan (Prov. of Buenos Aires).

b) *Agricultural education in the provinces.* — The Province of Buenos Aires has possessed for the last two years the School of Pomology at Dolores. Its organization and working are very similar to those of the national practical schools. It disposes also of two important nurseries, situated at Baradero and Cazon.

The Province of Entre-Rios has founded and maintains five schools:

1. The "Alberdi" Normal School for Rural Schoolmasters, situated near Paranà, the capital of the Province. — 2. The Agricultural, Animal Husbandry and Industrial School at Villa Urguiza, also near the capital. — 3. The Don Cristobal Agricultural School (District of Nogoyà). — 4. The "General Urquiza" Agricultural School (District of Villaguay). — 5. The Agricultural School at Concordia.

The courses in these schools extend over three years.

The "Alberdi" school prepares rural teachers for the elementary schools in which notions of general and special agriculture, of animal husbandry and of agricultural industries are given. The other schools turn out farm bailiffs and industrial foremen.

The Province of Sante Fè has instituted experiment fields in the district of Irigoyen, where varieties of cereals and forage plants are experimented ; it possesses also an experiment and demonstration field at the rural school at Godoy.

The Province of Cordoba has founded an agricultural office for the spread of notions of agriculture by means of departmental agronomists.

The Province of Mendoza has possessed for some years a Practical School of Agriculture at San Rafael.

c) *Special institutions for agricultural education.* — In the Argentine Republic there are also schools of agriculture kept up by private associations or by religions corporations ; these schools have in part the character of asylums for abandoned children.

Special mention must be made of the " Nicanor Ezeiza " Practical School of Rural Industries, founded by a group of inhabitants at Coronel Vidal (Prov. of Buenos Aires). This school is subsidized by the Government of the Province and will probably soon belong to it. It disposes of an estate of 617 acres with garden, nurseries, courts, pigstyes, lucerne fields, etc., and will soon have a butter and cheese dairy and a herd of 50 cows.

The school has been open two years, and its nurseries have already provided about 50 000 forest and fruit trees and during the year the number will reach 100 000.

The " Patronage for Children " maintains at Claypole (Prov. of Buenos Aires) an agricultural school with upwards of 200 children.

The Basque scholastic institution " Euskal Echea ", founded by the Euskarian community for the education of Basque Argentine children, possesses an agricultural school at Llavallol (Prov. of Buenos Aires) in an estate 50 acres in extent. The school is managed by Capuchin fathers, who give 100 children elementary education and a course of agricultural theory and practice divided into four years.

The Salesian fathers control four important establishments in the Republic :

1. " Don Bosco " agricultural school at Uribelarrea (Cañuelas, Prov. of Buenos Aires) with 1062 acres of land. It keeps 40 pupils. — 2. " San Pedro " College at Fortin Mercedes (Rio Colorado), 97 miles from Bahia Blanca, with 100 pupils. — 3. " Don Bosco " School of vine growing and market gardening at Rodeo del Medio (Prov. of Mendoza), with 100 pupils. — 4. " San Jose " agricultural school at Roca (Rio Negro), which occupies 1235 acres of irrigated land and teaches upwards of 50 pupils.

The Salesian fathers possess at Bernal (Prov. of Buenos Aires) 50 acres of land devoted to experimental cultures and to the production of fruit.

The " Niño de Dios " agricultural and industrial school at Victoria (Entre Rios) is managed by Benedictine fathers and disposes of 840 acres.

The Present State of Irrigation in Germany

by

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Up to within the last few years, irrigation in Germany was limited to water meadows, of which the oldest records date back to the 16th century. Though for several decades information on the irrigation of fields and gardens in other countries awoke a certain interest, nothing was done in this matter because the returns from the land without irrigation were satisfactory and because the rainfall in Germany was considered sufficient to ensure full crops. While irrigation flourishes principally in those countries where the yearly rainfall does not average more than 250 mm. (10 inches) and is moreover unfavourably distributed in the course of the year, Germany has no part of its territory that gets less than 400 mm. (16 in.), and of this quantity a great part falls during the time that plants grow (summer). Nevertheless it is not only the question of the total amount of rainfall occurring in a length of time, but also that vegetation should be spared periods of drought, even if these be only temporary. Already Hellriegel (1) had shown by means of pot experiments how injurious to the crops quite temporary spells of drought are, in spite of subsequent abundance of water. Still more conclusive are the results of lysimeter experiments which indicate the amount of water required for the production of 1 lb. of crop or of dry substance, and compare the quantity of water required for the production of a good crop with the rainfall. The figures thus obtained are in truth distant from each other. Thus, for instance, much larger quantities are required when water is given in excess or when irrigation is practised with insufficient manuring. The limits are not too far apart when the consumption of water required for the production of the heaviest crop, if sufficiently manured, is considered per unit of water (2); this must be the aim of the whole irrigation problem.

The Kaiser Wilhelm's Institute of Agriculture founded at Bromberg in 1906, and especially its section devoted to land improvements, considered it one of its chief duties to study the water requirements of field crops and consequently the profitableness of field irrigation.

By means of the lysimeter experiments carried out there, it was found that the total evaporation from plants and soil during the period of vegetation in relation to the rainfall stood as shown in Table 1.

(1) HELLRIEGEL: *Grundlagen des Wasserbaues*, p. 452 ff.

(2) *Mitteilungen des Kaiser Wilhelms Instituts zu Bromberg*, I, 373; II, 163; III, 171; IV, 118 and 132; V, 210.

TABLE I.

Year	Crop	Months								Total	
1909	Oats	IV		V		VI		VII		IV to VII	
		mm.	in.	mm.	in.	mm.	in.	mm.	in.	mm.	in.
Rainfall	—	51	2.00	5	0.20	43	1.69	65	2.56	164	6.45
Evaporation	—	17	0.67	73	2.87	206	8.10	162	6.97	458	18.02
1910	Rye	IV		V		VI				IV to VI	
Rainfall	—	33	1.30	64	2.51	109	4.29			206	8.11
Evaporation	—	59	2.32	158	6.22	148	5.83			365	14.37
Mean Rainfall	—	34	1.34	48	1.89	58	2.28	65	2.56		

The last line of the above table represents the average rainfall for Bromberg according to observations extending over upwards of 60 years, from which it appears that 1909 was a dry year and 1910 a wet one. But in both cases the amount of water required by the plants was considerably above that offered by the rainfall, and in some months to such an extent that it is doubtful whether without irrigation the soil would have been able to supply the deficiency from its store (subsoil water), especially in soils possessing a low water capacity, which are the first to be considered for irrigation purposes. The results obtained in both years by irrigation confirm this doubt. The unwatered plants were evidently injured by the spells during which their need of water was not fully covered by the rain. The same results were obtained in all the irrigation field experiments carried out at Bromberg. Even in the wettest years, to which especially 1912 belongs, there are some short periods of drought, and consequently irrigation proved beneficial, as may be seen from Table II.

In only two out of the six years during which experiments were made was the rainfall inferior to the average (205 mm. = 8.07 in.), and yet every year considerable increases of crop followed upon irrigation. The increases are higher than those obtained in similar experiments in America, especially if their higher market value in Germany is considered. There are, in Germany, extensive territories which lie under the same climatic conditions as the experiment field at Bromberg; about 8 150 000 acres have a yearly average rainfall of less than 500 mm. (about 20 in.), and besides these there are extensive areas with greater rainfall which yet suffer from frequently recurring shortage of rain. From the above it may be concluded that in Germany irrigation has a great future before it.

There are, however, two circumstances which tend to act as limiting factors. One is that, according to experience hitherto gained, only light

TABLE II.

YEAR	Rainfall IV-VII		Crop	Yield per acre				Increase per acre of watered plot *		100 cub. ft. of water produced
				dry plot	Watered plot					
	mm.	in.		cwt.	mm.	in.	cwt.	cwt.	£ s d	d
1907	298	11.7	Oats	12.74	115	4.5	19.11	6.37	3 9 10	5.09
1908	237	9.3	«	9.56	140	5.5	19.11	9.55	5 9 11	6.59
1909	163	6.4	»	11.95	140	5.5	24.69	12.74	5 19 0	7.13
1912	276	10.9	»	23.90	20	0.8	27.88	3.98	1 19 3	16.48
»	»	»	»	23.90	100	3.9	28.67	4.77	2 8 9	4.10
1909	163	6.4	Potatoes	136.20	110	4.3	258.07	121.87	7 11 2	11.52
»	»	»	(Starch)	22.30	110	4.3	47.79	25.49		
1911	105	4.1	Potatoes	62.13	280	11.0	209.49	147.36	—	13.72
»	»	»	(Starch)	11.15	280	11.0	43.81	32.66		
1910	294	11.6	Winter rye	15.93	80	3.1	19.11	3.18	1 15 8	3.73
»	»	»	Spring rye	9.56	70	2.8	12.74	3.18	1 10 2	3.50

* The cash value of the increase of crop was calculated at current market prices.

soils seem to be suitable for profitable irrigation, though it must also be noted that up to now irrigation experiments on heavier soils have been conducted to a very limited extent and require to be completed. The second obstacle lies in the extraordinary difficulties in the way of procuring the necessary water, because almost everywhere older water rights are encountered; one might almost say that every drop of water is somebody's property and is not to be had without indemnifying the owner. Besides this, it is not everywhere that water is to be found within accessible distance of the fields to be irrigated. To a great extent this difficulty is met by providing subterranean water by means of wells, but even this not easily available and expensive source is threatened, because according to the new Prussian laws on water, an indemnity must be paid to neighbours who suffer any loss by the tapping of underground water, whereas formerly every landowner was absolutely free to use any subsoil water he found on his property.

While these difficulties are to be regretted, as there is no other utilization of water as profitable as that of using it for irrigating fields and gardens, circumstances must be taken as they are; and consequently only

such irrigation systems as allow of the smallest consumption of water have been adopted.

Experiments made with wasteful furrow irrigation soon showed that there was too much loss of water by infiltration before it reached the places where it was required. This system allows only of an unequal distribution of water and is applicable only in especially favourably situated localities. There remains then only sprinkling from above like rain. With this method also there are losses, because the water adhering to the leaves and stems of the plants is evaporated and almost completely lost as plant food. Still this loss is relatively small, and sprinkling allows of a uniform distribution of the water over the field without any preparation of the latter.

In order to apply this system of watering, the water must be sent to the field under pressure in pipes ; by this means it can be sprinkled on the land so that it all soaks into the soil and none flows off the surface. On light soils it has been found that the density of the rain must not be above 1 mm. (0.039 inch) per minute, if this condition is to be fulfilled. In the oldest installation of this kind — at Eduardsfelde near Posen — the town sewage was used in this way and sprinkled by means of hose piping attached to the pipes conveying the liquid under pressure. This system requires much labour and has further the drawback that in sprinkling by hand a uniform distribution of the water is not attainable, and consequently the method is liable to be connected with waste of water (1). Owing to the recognition of this fact, the mechanical distribution of water by means of moveable carts has been adopted ; this method requires less labour to accomplish the same amount of work and does it more uniformly.

At present three such systems are in use and they are named after their inventors : Hartmann, Von Szczepkowski and Rodatz. A full description of the details of each system would be out of place here, besides which it has been given in other publications. (2). All three systems have in the main given satisfaction. The injury they have caused to the fields, if any, has been very small. If in their details there are still some weak points, these may be considered as trifling, due to the novelty of the thing and to be soon overcome. To this end a prize offered by the " Deutsche Landwirtschafts Gesellschafts " will contribute greatly.

Besides these three systems of portable apparatus, two systems of fixed apparatus for the watering of gardens are to be mentioned : one by Herr Pusch, Civil Engineer (Berlin) and the other in use at the seed-breeding farm at Quedlinburg. The cost of an installation for watering fields is considerable and so is its working. The greater part of the expense is represented by the costly iron pressure pipes. When these are fixed and laid under the ground the complete plant costs from £ 8 to £ 10 per acre,

(1) *Mitteilungen des Kaiser Wilhelms Instituts*, V, 220.

(2) *Deutsche landwirtscaftliche Presse*, 1912, Nos. 3 and 4; *Veröffentlichungen der Oekonomischen Gesellschaft in Dresden*, 1913; *Mitteilungen der D. L. G.*, 1913, Parts 7 and 18. (See also No. 486, *B.* March 1912, where illustrations of two systems are given. — *Ed.*).

without the steam engine, which however need not be specially reckoned, because most large farms possess one which is not required for other work when the time for irrigating comes round. Much cheaper than the above, especially for large estates, are portable pressure pipes, which diminish the cost by about one-half. If the field to be irrigated is especially favoured by its form and situation as regards the water supply, the cost of installation can sink to £2 per acre and even less (1). Recently, also, reinforced concrete works have already been partially successful in their attempts to manufacture cement pipes reinforced with iron, able to stand high internal pressure. If they should succeed completely in producing a cheap substitute for the expensive high-pressure iron pipes, the cost of field irrigation plant would be very much reduced.

The average amount of water required for the intensive irrigation of the various crops may be assumed to be about 14 000 cub. ft. per acre per year. Recently the question has been much discussed whether extensive irrigation, that is for a given quantity of water irrigation of a large area with small quantities of water, is to be preferred to intense irrigation of a smaller area. It appears as if the decision will be in favour of extensive irrigation, as some experiments made in the United States would show (2). Should this really be further confirmed, the cost of the plant and of the labour per unit of area would be still further reduced.

The increases of yield obtained by irrigation on the experiment field at Bromberg have not failed to draw the attention of practical farmers, with the result that at present in the dry east of Germany already about 5 000 acres of arable land, belonging to 15 farms, are under irrigation. One estate has set up a plant for about 2 500 acres, with a central electric station to supply the necessary power. The attempt to sprinkle a dry meadow was followed by a great increase of gross returns, but by no net profit (3). Grass makes great demands upon the quantity of water, but yields a hay of relatively low value, which does not pay the expense of water under pressure.

In general all the experiments made on the irrigation of various crops show that the net profit due to irrigation varies with the market value of the crop. Owing to this being recognized in Germany, the installations for the watering of orchards and market gardens are increasing in numbers. While market gardens can be treated by sprinkling, orchards do not stand it well, as the fruit is liable to be damaged by it. Besides, sprinkling between the trees can be carried out only with difficulty even with a hose. It is therefore advisable to water orchards by furrow irrigation, as is done in the United States.

In conclusion it may be stated that at present in Germany also, the interest in irrigation is widely felt, as the considerable application of this clearly shows. If recently complaints about the celebrated irrigations in

(1) *Mitteilungen der D. L. G.*, 1913, Part 18.
(2) *Illustrierte landwirtschaftliche Zeitung*, 1913, No. 41. (See No. 228, *B.* March 1913. - *Ed*).
(3) *Mitteilungen des Kaiser Wilhelms Instituts*, IV, 123.

the United States have reached us (1), we need not fear that any such unpleasant surprises await our irrigation schemes, the composition of our soil and the method of sprinkling that has been adopted here being sufficient guarantee. But as has already been stated, the area of the land which should and can be irrigated is not large; consequently irrigation in Germany will never have a great economic importance.

Nevertheless, considering the success already attained, no favourable occasion for the installation of an irrigation plant should be neglected.

Seed Control in Austria and its Effect upon Agriculture and Trade

by

Dr. THEODOR Ritter VON WEINZIERL, Imperial and Royal Councillor.

Director of the Vienna Seed Control Station.

The beginning of the regulation of the seed trade in Austria coincides with the founding of the Vienna Seed Control Station in 1881 by the Imperial and Royal Agricultural Society of Vienna (K. K. Landwirtschafts-Gesellschaft).

The chief aims of this station were not only the elaboration and improvement of the scientific methods of examination of the various seeds of commerce as to their quality, and the organisation of seed control in itself, but also the carrying out of investigations and experiments in the agricultural study of seeds, on forage growing and later on seed breeding, in connection with several field experiments on the agricultural value of the often highly advertized seeds placed on the market and sent in for analysis. Owing to its present sphere of activity as an independent botanic experiment station, the Vienna Seed Control Station has been taken as a model in the institution of similar stations elsewhere in Austria and abroad.

It started 32 years ago with very modest beginnings and has now developed into an agricultural institute upon whose many-sided activity great calls are made, and which at present is the largest experiment station of the kind.

Up to the year 1886, the Seed Control Station was situated in one room rented in a private dwelling, and limited itself to the examination of the most important seeds of commerce. At the initiative of the writer, who since the foundation of the Institute has been connected with it, the station was transferred to the premises of the Imperial and Royal Agricultural Society and its activity was extended beyond the analyses of commercial seeds, in the new direction of experiments principally on forage and cereal crops.

(1) *Kölnische Zeitung*, 1913, No. 153.

In 1895 the Station was taken over by the State and removed to the building of the Ministry of Agriculture, where it remained until 1895, when, through the munificence of the Emperor, a plot of land about one acre in extent in the Prater was secured ; on this a building for the station was erected, surrounded by a garden suitable for small cultivation experiments.

Work of the Station.

I. — *Examinations* (*analytical work*). — In the first place the determination of the practical value of the various seeds of commerce, namely *authenticity*, genus and species, *origin*, *dodder content*, *degree of purity* in percentage by weight, *germination capacity;* further the *water content* (in seeds, fruits and tubers). Then there are examinations of sugar beet and mangold seeds as to impurities, germination capacity, number of clusters per gram, etc.; and for cereals, the *hectolitre-weight*, the *absolute weight* of the grain, total weight and percentage of sprouted, broken, bruised, gnawed, smutty or ergoted grains; further, in the examination of *bread cereals* or of their meal, the *baking value* is ascertained. *Barley* for the brewery is submitted to a complete analysis for water content, purity, hectolitre-weight, absolute weight, proportion of husk, mealiness, plumpness, grade, content of crude protein, purity of variety, proportion of damaged grains, germination capacity ; and germination energy. The Station also examines *concentrated foods* (bran, meals, oilcakes, etc.), and this not only to determine their purity or possible adulteration, but also (according to Weinzierl's mechanical and microscopical method) their meal and husk content ; the colour of the meal is also determined with the object of judging its type. Lastly, the Station determines the species of cultivated plants or weeds, investigates plant diseases, examines *hops*, carries out complete botanical analyses of hay and undertakes researches on plants and parts of plants of importance to agriculture.

No slight aid to the constant progress of the systematic cultivation of forage crops has been afforded by the Station during nearly a quarter of a century by its formulae for *seed mixtures* issued at the request of farmers for seed leys, permanent meadows, pastures, alpine pastures, etc.

Of great importance for regulating the trade in clover seed, especially as regards the essential quality of freedom from dodder, has been the practice adopted by the Station since 1882 of sealing with leaden seals the sacks of seeds in the merchants' warehouses. This practice is a speciality of the Station and has been followed by other experiment stations.

As for the use made of the Station by the public, it need only be stated that in the year in which it was founded the number of analyses carried out, including sealing of sacks, was 122, while last year (1912) the number rose to about 30 000.

In 1907 a branch station was opened in the Agricultural Exchange in Vienna; it was the first of its kind and proved to be a valuable adjunct. It is situated in immediate proximity to the common Exchange hall and is connected with it by means of a hatchway which allows people in the

Exchange to submit the samples presented for sale to a summary investigation on the spot, and to get immediate results upon which commercial transactions may be based.

II. — *Experimentation (field experiments)*. — Among the duties of the Seed Control Station as an agricultural botany experiment station the following are the most important:

1. Encouraging the cultivation of forage plants by carrying out field experiments with them, installation of forage crop stations, cultivation and breeding of forage plant seeds, experimental growing of forage crops in the Alps. The last-named are made in the experiment garden on the Sandling Alp near Bad-Aussee, and in other alpine seed gardens instituted by agricultural associations or by the authorities in Austria at the initiative of the seed Control Station; further, since 1909 experiments have been made at the Imperial and Royal Kragl estate, near Mitterndorf; the breeding of grasses and pasturing, and plants useful as litter have been dealt with on special experimental areas.

2. Promoting the breeding and cultivation of cereals, flax, beets and mangolds, potatoes, maize and forage plants, as well as plant breeding in general, by means of experiments intended for the improvement of the varieties of the country and for the breeding and spreading of new and suitable varieties on the one hand, and for keeping up the productivity of the foreign varieties that have been introduced and found advantageous, on the other. Lastly, the results of these scientific and practical field experiments are made known by means of publications, lectures, courses and demonstration plots.

3. Stimulating the formation of organisations for the furthering of agricultural crop production, especially the raising and breeding of seed, in peasant farms or by agricultural associations.

4. Lastly, the furthering of the scientific bases of agricultural crop production in general, especially by means of scientific investigation in the study of seeds, on the question of the formation of new plant forms in the most important crops, etc.

For carrying out small experiments of cultivating new varieties of cultivated plants, seeds of doubtful origin, breeding experiments, etc., the garden of the Station containing fifty plots, making together 0.827 acre, is available. For experimentation in winter there is a glass house built in 1907 in the garden of the Station.

Methods of Seed Control.

With the object of obtaining uniformity in the methods of seed control in Austria, a special expert commission for seed control under the presidency of the writer was appointed under the Federation of Agricultural Experiment Stations founded in 1911. This commission drew up and published, in a book (1) dealing with the methods to be followed, the spe-

(1) *Methodenbuch. Niederschrift der für den Verband der landwirtschaftlichen Versuchsstationen in Oesterreich ab 1. Januar 1913 geltenden analytischen Verfahren und Grundsätze.* — Published by the above Verband, Wien II., 1st. Edition with 9 figs. Vienna, 1913.

cial instructions which have been enforced since January 1, 1913, and which in their main lines are the following :

For every examination a small *average sample* is made up from the sample sent in.

The determination of the *authenticity* consists in determining whether the sample agrees with the designation given to it, as to genus and species. The authenticity of a variety is at the request of the sender to be determined by an experiment in the open.

The very various places of origin of the clover seeds found in the trade are to be indicated by one of the following fixed denominations : Central European, South European, West European, North European, East European, North American, South American, Asiatic and Australian.

a) European seeds whose origin cannot be ascertained for certain are to be designated as " European seed ".

b) American seeds which cannot be recognised certainly as coming from North or South America are to be designated " American seeds ".

c) Seeds which are free from those characters which are considered typical of American seeds are to be designated " free from American characters ".

d) Seeds which besides the characters of other origins contain also those of American seeds are to be designated as "containing American characters. "

e) Samples which are recognized without doubt as mixtures of various origins are to be indicated with the observation " containing... "

In the *determinaton of purity* the following are to be separated : earth, sand, stones, chaff, foreign seeds and damaged and shrivelled seeds of the variety in question in so far as these are undoubtedly incapable of germination.

Samples sent in for *examination for dodder* are to be passed through a suitable square-meshed sieve and both those which pass through and those which remain on the sieve are to be examined.

Any sample of clover, timothy or flax containing even only one normally developed dodder seed is to be declared " containing dodder ".

The number of seeds of " Kapselseide " and " Grobseide ", as well as the number of seeds of clover dodder in the small-seeded clovers and in timothy, are not to be indicated.

If on the subsequent examination of a parcel of seeds *warranted* as dodder-free or of one sealed by the Seed Control Station, five or more dodder seeds per kilogram (2.2 lbs.) are found, the vendor is bound to take the seeds back again at the request of the purchaser. If less than five seeds per kilo are found, the vendor must bear the cost of another cleaning of the seed.

The seeds for a *germination test* are counted out of an average sample, which is taken at the same time as the sample for the determination of purity.

For the determination of *germination capacity* two parallel sets of

tests are to be made, each with 200 good ("pure") seeds. For large seeds (maize, beans, acorns, etc.) usually two sets of 100 each are sufficient.

Several kinds of seeds are steeped before being put in the germinator.

As germinating bed, filter paper, pure quartz sand and sterilized porcelain dishes are allowed. The moisture must not exceed 70 per cent. with filter paper and 20 per cent. with sand. Otherwise the optimum moisture depends upon the kind of seed and the germinating medium. The choice of the germinating bed depends upon the kind of seed to be tested.

The paper germinating bed must consist of several sheets of sufficiently thick and absorbent filter paper laid over each other and so arranged as to admit the necessary access of air.

The daily amount of water is to be given by sprinkling the lowest sheets of paper from a wash-bottle specially arranged for the purpose, never directly onto the seeds.

The sand germinating bed, besides being used for beet seeds, is sometimes used also for the control of the experiments made with filter-paper on lupins, sainfoin, peas, beans and cereals. It is made by mixing clean river sand with spring water, the quantity (1) of which is determined by the size of the grains of sand (2). The wet sand is placed in a suitable glass dish, then pressed with a marker which makes 100 small holes, in which the selected beet clusters are placed; the whole is then covered with a glass plate and glass cover.

The germinating beds, both paper and sand, containing the seeds are then put in the Weinzierl germinating case, the former on strips of glass, the latter on wooden laths, where the seeds that require it are submitted to intermittent temperature. Such are *Agrostis alba*, *A. vulgaris*, *Aira caespitosa*, *Alnus*, *Alopecurus*, *Anthoxanthum*, *Avena flavescens*, *Dactylis*, *Beta*, *Betula*, *Daucus*, *Glyceria*, *Holcus*, *Nicotiana*, *Phalaris arundinacea*. *Pinus Strobus*, *Poa* sp., *Zea*; these are kept for about 10 hours at 18° C. and for 14 hours at 28° C. All other seeds are placed in an unheated germinating case at room temperature (15° C. or 20° C.).

In every germinating case with paper beds, care must be taken to provide fresh air, but this must be as moist as possible; it is best obtained by placing a tin vessel full of water on the heated bottom, and ventilating daily.

If gas heating is employed, Weinzierl's safety burner is useful; with electric heating, the best is a heater let into the bottom of the germinating case. The temperature must be regulated by reliable automatic regulators.

Whilst, as a rule, germination trials are carried on in the dark, parallel tests in diffused daylight are recommended for *Poa* spp., *Dactylis*, *Phacelia* (these require also a lower temperature, 15° C.), *Larix europea*, *Pinus sylvestris*, *P. maritima*, *P. Strobus*, *Alnus* spp. and *Betula* spp.

(1) 400 cubic centimetres.

(2) 0.25 to 0.5 millimetre.

The most favourable result (if superior to the " dark " test) is to be taken as the final one.

On the process of germination preliminary communications may be made.

If deviations of more than 10 per cent. between the parallel tests are observed, the test must be immediately repeated with 2 × 200 grains. In the case of cereals, lupins, sainfoin, peas and beans this is to be carried out with sand beds.

The number of sprouted seeds referred to 100 gives the percentage of germination. In the case of lucerne one-half of the hard seeds, and for the other clover seeds one third, has to be added to the number of sprouted seeds ; but the actual results must also be given.

For forest seeds, on conclusion of the test the number of seeds that have not germinated but are fresh is to be specially mentioned in the report. For *Abies, Acer, Carpinus* and *Fraxinus* only the section test is practised.

Limits of error (1).

1. For the practical value: 5 per cent.
2. For beet seeds the following rules are to be observed:

If a second examination of the same beet seed shows differeuces in some properties and these differences lie withim the limits of error of analysis, the two results are to be considered as agreelng with eaeh other.

The limits of error of analysis are the following:

1. In water content	1 per cent
2. In the content in foreign matter and in the imperfetiy developed clusters in results up to 3 per cent.	1 »
3. In the number of clusters per gram 5 per cent. In the germination capacity (seedlings and clusters capable of germination).	10 »

Subsequent control. — The purchaser must send to the Seed Control Station for further examination an average sample of the quantity, taken in the presence of two witnesses and accompanied by the duly filled in guarantee certificate.

The subsequent examination is to be carried out on principle free of charge for the buyer of at least 5 kilos (11 lbs.) of goods from a so-called contract firm (Vertragsfirma).

The fee for the subseqnent examination is paid as a rule by the firm and amounts to 50 per cent. for the normal tariff ; the same is the case also for the purchaser when he offers to bear the expense.

The right of the purchaser to claim compensation ceases :

a) When the sample is not sent in within 8 days from the date on which the goods were received.

(1) The limits of error are considered only for the published final results, while the deviations allowed for the individual determinations are given in the descriptions of the methods of examlnation.

b) When the claim for compensation has not been made within 8 days of receiving the result of the subsequent examination.

In cases of differences being found, the amount of compensation is calculated on the basis of the guaranteed practical value and that of the goods delivered, and taking into consideration the normal limits of value for all kinds of seeds with the exception of beet seeds, according to the formula :

$$Ab = \frac{Pr}{100 \times Gb} \times V \times Qu,$$ in which.

Ab = Compensation.
Pr = Price per 100 kg. (220 lbs.).
Gb = Guaranteed practical value.
V = Percentage to be compensated.
Qu = Quantity purchased.

For beet seeds the amount of compensation is arrived at by calculating the so-called value index (Wertzahl according to v. Weinzierl) (1) as the percentage ratio between the value guaranteed and that delivered.

Sealing with leads. — On principle the sealing of sacks is only done in the permanent warehouses of the contract firms. In other places, such as public storehouses, railway premises, etc., it is done only exceptionally and with the consent of the board of the Seed Control Station.

The clover seeds to be sealed must be put in seamless sacks and placed in large stores free from dust, in such a way as to allow of easy access to the officials charged with the sealing.

The sacks must then be closed by passing a needle and twine right through them at the spot where they are to be tied and then tying them round two or three times.

At the ends of the twine a label (Spitzzettel) which bears the same number as its counterfoil (Attest), is first hung and then they are closed with the leaden seal upon which the official dies impress the month and year on one side and on the other the Austrian eagle with the inscription " K. K. Samen-Kontroll-Station in Wien ".

An average sample is taken from different parts of each sack to be sealed and is put into a small, also seamless, bag, which is likewise closed with the Station's seal.

The examination of these samples is performed without exceptiou in the laboratory of the Seed Control Station. The firm is immediately informed of the result and requested to remove the leads and labels from all the sacks about which doubts arise and to send them by return of post to the Station.

As fit to be sealed, the Station considers only those leguminous seeds which have been found on examination to be " dodder-free " (2) and which

(1) Cfr. v. WEINZIERL: Eine Wertzahl für Rübensamen. — *Wiener landw. Zeitung*, 1910, No. 75.

(2) As " dodder-free " seeds to be sealed are considered only those which do not contain one single developed grain of dodder in the average sample taken from them.

present the appearance of being seeds capable of germination that have been cleaned with the best machines. Besides this only such red clover and lucerne seeds are admitted which are evidently not of American origin and contain no admixture of American seeds.

The origin of the clover seeds is not given in the sealing certificate, and consequently a special written guarantee must be demanded from the vendor. An exception is made for those seeds which are recognised as Turkestan lucerne or South European red clover. These are for the present sealed, but on the certificate the origin is given.

In conclusion, and in order to give a clear idea of the whole work of the Vienna Seed Control Station as it is at present, it must be noted that it does not limit itself to the examination and analysis of commercial seeds, but as a natural complement of its control work it carries out field experiments, and scientific research on seed breeding, growing of grass seeds, and on the value of the different varieties of seeds put on the market ; it thus acts as an agricultural botany experiment station (1), as is set forth in the second title which the Seed Control Station bears according to its statutes.

The Cattle Industry in Britain

by

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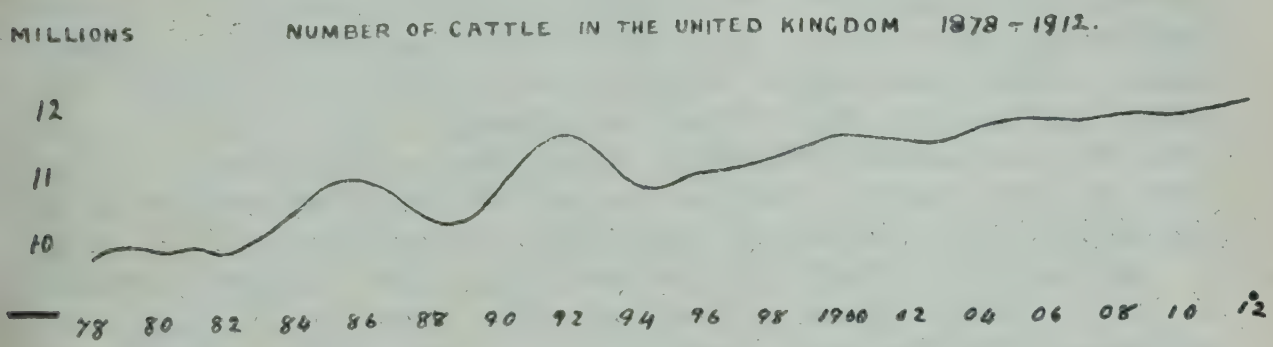
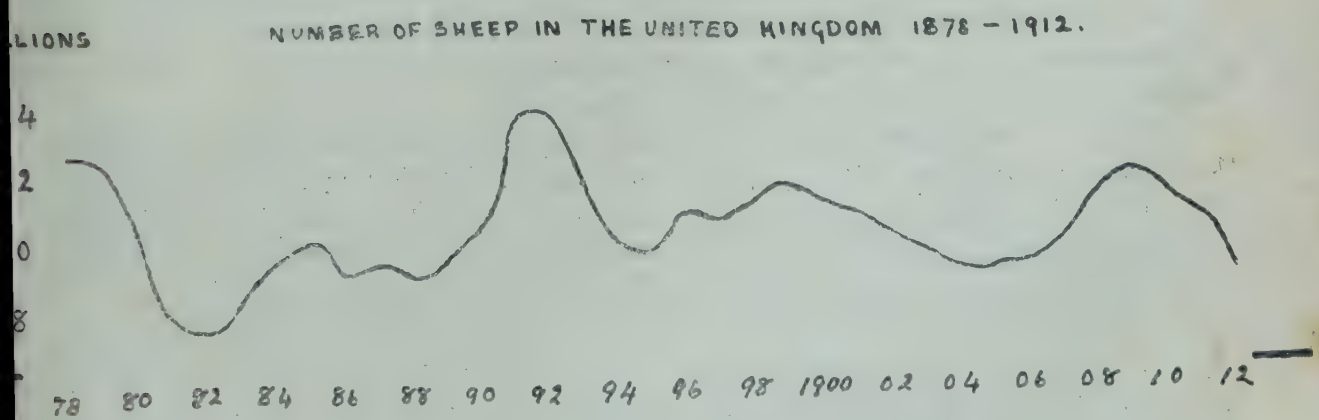
It is impossible accurately to trace the development of the Cattle Industry in Britain throughout any very long period of time, as accurate statistics are available only for the latter part of the previous century and for the present one. The only statistical statement of earlier times on which any amount of reliance can be put, is that of Davenant, published in 1688. Davenant estimated that there were, in England and Wales, four and a half million cattle, twelve million sheep, and two million swine. The population at the time was put, probably with a considerable degree of approximation, at 5 ½ million persons. There are, at the present time, in the same portions of the United Kingdom, about 6 million cattle, 19 ¼ million sheep, and 2 650 000 swine. Cattle have therefore increased, in the 2 ¼ centuries, by about 33 per cent., while the average increase of the three classes of meat-producing animals has been about 43 per cent. During the same period the population has increased about six and a half fold. It is probable that a greater increase in the live stock would be shown, could Scotland and Ireland be taken into account.

(1) " Wirkungskreis und Dienstinstruktion " für die Abteilungen an der k. k. Samen-Kontroll-Station in Wien (approved by Order of the Ministry of Agriculture, No. 1820, 1908). Publ. No. 368.

Since 1878, from which time accurate statistics are available, the number of cattle in the United Kingdom has increased from about 9 3/4 millions to almost 12 millions. This increase is shown by the accompanying chart (Fig. 1) in which the number is plotted for the 35 years in question.



The fluctuations are somewhat irregular during the first part of the period, but the second part of the curve shows a very steady upward tendency. This increase in numbers, however, has not been in proportion to the growth of the population, for in the same period the latter has increased from about 33 ½ to about 45 ½ millions. Thus an increase of 36 per cent. in the population has been met with one of only 20 per cent. in the head of cattle. At the same time cattle constitute the only group of live stock which have, as it were, made any attempt to meet the growing needs of the population. Fig. 2 shows the variation in the number of sheep during the period mentioned, and it will appear from it that, while there have been somewhat rapid fluctuations in the number of this class of stock, there has been no marked or definite tendency either in one direction or the other.



The National herd of cattle has thus been growing fairly steadily during the last 35 years. At the same time we may trace from the figures of the last 20 years, which are all that are available, a small but interesting change in its composition. The proportion of the whole

returned as "cows or heifers, in milk or in calf", has remained fairly constant throughout, varying between 35.7 and 37.3 per cent., and showing no definite tendency either to increase or to diminish. On the other hand, those grouped as "other cattle, 2 years old and over" have fairly steadily decreased, from 24 per cent. in 1893 to just under 20 per cent. in 1912. There is a corresponding increase in the proportion of yearling cattle and calves, the said increase being about evenly divided between the two groups. It is probable that the change in the cattle industry which these figures illustrate has continued for a much longer period than that for which figures are available, and has, in the mass, been much more extensive than the figures show. There appears to have been a long-continued tendency to market cattle for slaughter at a diminishing age, which has probably lasted throughout a century or more.

It is difficult to decide from statistics what sort of change has occurred in the available supplies of food for cattle. According to the official estimates, there has been a considerable decrease in the national root crop in the past 35 years, from over 2.9 to under 2.6 million tons, or about 13 per cent. On the other hand the total area of pasture and hay increased very considerably up till about 10 years ago, since when however it has shown a tendency to diminish. There has also, without doubt, been a very great increase in the imports of cakes and meals, etc., for cattle feeding, although no statistics are available to show its extent.

The live stock industry of Britain is, of course, insufficient to supply the needs of the home population, whether for meat or for dairy produce or wool. At the same time the home production of meat bears a very much larger proportion to the total consumption than does that of grain. Mr. Rew has recently calculated that the country produces about 55 per cent. of its total requirements of meat, by weight, as against less than 20 per cent. in the case of wheat. Moreover, it is in the case of beef that the home production most nearly approaches the consumption, for while the country as a whole produces slightly under 50 per cent. of its total requirements of pig meat, and only slightly over 50 per cent. of its consumption of mutton and lamb, the total home production of beef is slightly over 60 per cent. of the consumption.

There are sixteen well recognised British breeds of cattle, without counting separately the Lincoln Red and the Dairy sections of the Shorthorn, which have their own special breeders' associations. Of these five (the Ayrshire, Jersey, Guernsey, British Holstein, and Kerry and Dexter) are special dairy breeds, while the others are classed as beef breeds or dual purpose breeds. The latter group includes the Shorthorn (with the two branches already mentioned), the Hereford, Longhorn, Devon, South Devon, Sussex, Black Welsh, West Highland, Galloway, Aberdeen-Angus and Red Poll. The majority of these breeds, whether we consider pedigree herds or ordinary commercial breeding herds, are fairly strictly local, being confined to those parts of the country included in, or adjoining, the counties or districts by which the breeds are named. Others, such as the Aberdeen-Angus, Jersey and Guernsey, while still commonest in their

native districts, are widely distributed over the country generally. The Shorthorn is of course at once the commonest and the most widely distributed breed.

Each of these breeds has a special association of its breeders, which watches over its interests in many different directions. Chief among the activities of these societies is of course the compilation and publication of the herd book. The advantages, as well as the *modus operandi*, of the ordinary system of registration are probably sufficiently well known. Some British herd books are "closed"; that is to say no animal may now be entered in them unless it be the progeny of registered parents on both sides. Others are "open", and accept for registration animals which have a certain minimum proportion of their ancestors registered. The latter system makes it possible for a breeder gradually to render his cattle eligible for registration by the continued use, through three or four generations, of pedigree bulls, and without necessitating the purchase of pedigree females. Some breed societies endeavour to forward the interests of their members by holding special auction sales of stock, and in particular of young bulls. Examples of such sales are those of Herefords at Hereford, of West Highland bulls at Oban, of Devons at Taunton and Exeter, etc. Most of the Societies also offer medals and prizes for their respective breeds at live stock shows, both at home and abroad. Other and various methods of advertisment are employed from time to time.

Most important of the remaining associations in connection with the cattle industry are the milk record societies. Up till ten or twelve years ago Britain was far behind many other countries in the matter of record keeping, but since that time very rapid progress has been made. In the Ayrshire district for example, where the work commenced as late as 1903, there are already 24 societies in existence and in 1912 records were taken of 438 herds, and of 18 356 individual cows. The societies are co-operative, but are supported by grants from the Highland and Agricultural Society of Scotland, the Ayrshire Cattle Society, and now also by Government. Testing, both with regard to quantity of milk and percentage of butter fat, is carried out in each herd about every 21 days. Except in Ireland, where an excellent system of Government assistance to stock breeding has been in force for a considerable time, no extensive grants have been made by Government for the encouragement of cattle breeding. A scheme has however been published in the present year whereby, among others, a grant of £5000 yearly will be available for the purpose of subsidising milk record societies, and one of £13 800 for the provision of pedigree bulls.

Live stock shows have been developed in Britain to an extent which is probably unparallelled in any other country. Besides the large exhibitions held annually by the Royal Agricultural Society of England, the Smithfield Fat Stock Club, the Highland and Agricultural Society of Scotland, the Royal Dublin Society, the Bath and West of England Society, etc., there are innumerable district, county and local shows. Their influence, both in

the direction of encouraging enterprise in breeding and in that of educating the ordinary farmer, has been enormous.

A well-developed system of auction sales also exists, which acts greatly to the benefit of breeders by facilitating the choice of breeding animals. Sales of cattle are held in connection with the Royal and Dublin shows; others are organised, as already mentioned, by breed societies; and other and very large sales of particular breeds are held by private persons or by auction companies. Among the latter, those of Shorthorns and Angus cattle at Perth, and those of Shorthorns at York and Birmingham are the most notable.

There is, as is well known, a large export trade in pedigree cattle from Great Britain. During the five years 1906-10 inclusive the annual exportation averaged 4830 head, and the average value is given at £45 a head. This number, however, includes an average of 1733 exported to the Channel Islands for food, so that the number of breeding animals was 3097 and the average value probably about £60. The United States of America on the one hand, and the republics of Argentina and Uruguay on the other, are by far the largest purchasers. In the period mentioned the former country took 32 per cent., and the latter two 30 per cent., of the total head exported. Canada and British South Africa are the next largest purchasing countries, having taken about 7 per cent. each, while Australia and New Zealand together accounted for about 4 per cent. of the total. Although no figures are available, it is well known that the Shorthorn is the breed which is by much the most numerously represented in the exports, and is that which is most cosmopolitan in its distribution. Herefords are exported in considerable numbers to South America and have, in the past, been taken in large numbers to the United States. Aberdeen Angus, Red Poll, Jersey, Guernsey, Ayrshire, Devon, Sussex and Galloway all play a greater or less part in the export trade, and there is probably no breed which is not occasionally represented.

The export trade has had a very marked tendency to raise the prices of the types of stock taken. The effect of foreign competition may be shown by comparing the prices brought by Shorthorns and Aberdeen Angus, the former of which breeds enjoys a large export trade at present, while the latter is comparatively neglected. At the two largest Shorthorn sales (Perth and Birmingham) some 1100 bulls were sold in the years 1912 and 1913, at the average price of £53. At the corresponding sales of Aberdeen-Angus, about 750 bulls brought an average price of £33.

A somewhat striking feature of the British Cattle Industry, if we compare it with that of other countries, is the extent to which particular districts have specialized in particular branches, for which their special conditions render them suitable. Thus there are districts in which dairying is the only important branch, and others in which rearing or fattening respectively predominate. The result of this is a very large trade both in young store animals and in others ready for fattening, the extent

of which may to some extent be judged from the fact that Great Britain imports from Ireland about half a million stores annually,

As regards systems of management, various methods of rearing are employed. In some regions, as for example the Western Highlands of Scotland, calves are brought up in the natural manner, on their own dams Needless to say this method can be employed for ordinary commercial. stock only on the cheapest class of land, where the cost of maintaining the cow for the year is low. In some cultivated districts a method of rearing is employed whereby the calves are suckled, but where each cow is made to rear two or more calves in the course of her lactation period. An extra calf, or in some cases two, are bought for each cow when she comes into milk and are put on along with the cow's own calf. Later, generally after about 4 months, these are weaned, and one or two others are put on. In this manner many farmers are able to rear an average of three, and in some cases of four, calves on each of their cows. A fairly docile and fairly deep milking stock of cows, as well as careful supervision, are necessary to make this system a success. The commonest method of rearing is however that by which the calves are pail fed, receiving whole milk only during the first few weeks, and being then gradually transferred to skimmed or separated milk with a cream substitute. Various substances are employed in the latter capacity, but crushed linseed and crushed oats or oatmeal are perhaps the most widely used. There are also many proprietary cream substitutes on the market.

There is not much to be said regarding the methods of rearing, from the time of weaning until the animal is ready to be fattened. In summer young cattle are kept at pasture, and rarely receive any additional feeding. In winter they may be kept indoors, generally in cevered or partially covered yards, or they may be left outside for the most part, depending on the climate of the district. The winter food consists of roots, hay and straw, with a small quantity of artificial food, often linseed cake in the case of very young animals, generally cotton cake for older ones. The proportions of these materials used to build up the ration vary considerably in different districts. In arable districts, and especially in the north, roots preponderate, while in grazing districts hay constitutes the main part of the ration, or sometimes, as in Ireland, practically the whole.

Fattening is, in summer, carried out for the most past on the grazing system, although sometimes the animals are kept in yards and fed with cut grass, vetches, etc. Some pastures are capable of fattening cattle without any additional ration, but generally speaking some 4 to 8 lbs. of feeding cake are given, at least during the finishing stages. Winter fattening rations show the same variation as do those for young cattle. In the north-east of Scottland, a typical ration would consist of 100 or 120 lbs. of turnips or swedes, 10-14 lbs. of oat straw and 4-8 lbs. of concentrates. In the eastern districts of England about half the above quantity of roots is employed, with part at least of the fodder in the form of hay, and generally a larger quantity of concentrate. In south-western England and in Ireland, the main part of the ration is hay, with a moderate al-

lowance of cake, and sometimes a small allowance of roots. Fattening cattle are perhaps most frequently kept in lots of 6 to 20 in covered or partially covered yards, but many are also fed in single or double boxes, or tied up in byres. The process of fattening generally lasts from 3 to 6 months, and finished cattle come on the market at anything betwen 15 months and 3 ½ years of age.

Systems of dairy management are many and varied. In cheese-making districts it is generally arranged for the cows to calve in spring, as it is not considered economical to produce any large quantity of cheese during the winter months. The cattle run at pasture in summer, and may receive perhaps 2 or 4 lbs. of concentrate, such as bean meal or cotton cake. In winter they are fed on a rather low ration consisting largely of hay, with perhaps 20 or 30 lbs. of roots and again a little cake or meal. In other districts, where butter or whole milk is sold, the cows are arranged to calve at more or less regular intervals throughout the year, and they are also much more intensively fed throughout the winter.

In the neighbourhood of many large towns, dairy men are frequently not breeders of cattle, and in many cases not even farmers. They purchase freshly calved cows, milk them for a period of ten or twelve months, fattening them in the interval, and sell them for slaughter at the end of this period. The ration consists of cut grass, vetches, etc., in summer, and of roots, hay and straw in winter, with an allowance of 10-15lbs. of cake, and meal or part equivalent of wet brewers' or distillers' grains in either case.

As regards the value of commercial stock, the average price of first quality Shorthorn cows, in milk, is given in the Agricultural Returns at £21 10*s*. for the last five years; and good specimens frequently bring £25, and occasionally over £30. The average price brought for all classes of cows in milk is probably between £17 and £18. Young calves of dairy breeds bring from 10*s* to 30*s*, and those of the larger beef and dual purpose breeds from 30*s* to £3. Two year old store cattle of the Shorthorn, Angus and Hereford breeds are quoted in the official returns at from £12 to £17, and £14 is probably about an average. The mean price of fat cattle for the past five years is given at 35*s* 2*d* per live cwt. (112lbs.), making the probable average price per head about £18.

At the present time, one of the main features of the cattle industry in Britain is the scarcity of stores, or at least the insufficiency of the supply of this class of cattle to meet the demands of feeders. The consequence of this is the high price at present ruling for stores, and the diminution in the profits of feeding. This points to the probability of a further, and possibly more rapid, increase in the national herd in the future.

There is also abundant evidence that more attention is being devoted to the improvement of dairy stock than has been, in the past, directed to this end. This tendency is shown in the very rapid development of milk record societies, as already mentioned, and also in the greatly increased prices that are now being paid for pedigree dairy stock, compared to those ruling a few years ago. The increasing importance of the dairy industry probably to a considerable extent accounts for this tendency.

Recent Experience and Progress in Moor-Cultivation in Germany

by

Geh. Regierungsrat Prof. TACKE, of Bremen.

The investigation of the natural history of moors in general, and of the scientific basis of their agricultural utilization in particular, is arousing interest in ever widening circles. The work of the Institutes specially devoted to moor investigations (Moor-Versuchs-Anstalten), of the Geological Institute of the country and of numerous individual investigators is being successfully directed to the extension of our knowledge of the origin, formation and alterations of the various types of moors from the geological, botanical and chemical standpoints. Remarkable efforts have also been made with the object of obtaining uniform definitions of the terms employed in the study of moors, and a classification of the various peat and moor formations, which however, have not yet led to conclusive results. Of special importance from a practical point of view is the not yet fully settled controversy as to the existence of so-called humic acids, especially in the free form. While on the one hand attempts are made to prove that all the phenomena attributed to reactions or free humic acids, consequently chemical processes, are nothing else than purely colloidal or physical effects, on the other hand the view is held on the strength of extensive researches and experiments that the undeniably colloidal state of humic substances does not by any means exclude the existence of real humic acids and of chemical reactions caused by them.

Extensive researches upon the bacteriological conditions in untouched and cultivated moors allowed striking differences in the kind and number of the existing lower organisms to be recognised, as well as the great effect produced upon them by the various operations of cultivation. Both bacteriological and chemical investigations proved that the very energetic decomposition of nitrogen compounds which under some circumstances takes place in moor soils, to the detriment of the yield, can be of a purely chemical nature. Closely connected with this question is that of the unfavourable effect of heavy liming on sour moor soils and those poor in lime, which in spite of much research has not yet found a satisfactory explanation.

Of practical importance is the result, that the quantity of lime to be added to very acid moor soils lacking in lime, especially when only cereals and hoed crops are grown, must be kept within narrow limits and under 16 cwt. per acre, calculated as calcium oxide. On the other hand, when the same land is put to permanent meadow or pasture, at least twice as much lime should be spread ; under certain conditions, especially with deep ploughing, still more is to be given to ensure success. No injury is to be feared here. The explanation of this phenomenon, which at first sight seems striking, is that the permanent flora of every good meadow

and pasture contains a sufficiently large proportion of clover, and this is favoured to such an extent by an abundance of lime that the unfavourable effect of much lime on the other grasses is not only made good but even outbalanced. According to recent experience, much stress is laid on the minute division of the substance used in liming moor and similar soils requiring lime.

Comparative experiments with various potash salts on moors, especially when strong doses are used and on permanent meadows and pastures, seem to show that the concentrated salts are more advantageous than the crude salts.

Crude phosphates, and also such as are of amorphous outer texture (soft earthy phosphates), are recognised unanimously as suitable only for those moor soils which remain very acid even under cultiva ion.

Among the new nitrogenous manures, the several kinds of nitrates obtained from atmosph ric nitrogen have in general proved as advantageous on moor soils as the ni rogenous manures hitherto successfully employed (nitrate of soda and sulphate of ammonia). Nitrate of lime containing nitrites has proved less successful. Cyanamide, when used early enough before sowing, has a greater or less effect on nitrogen-hungry moors according to the state of cultivation of the soil ; but the effect is generally little more than half that of the nitrogen in nitrate of soda.

In the practice of moor-cultivation the most important processes and progress are the following :

The improvement of fens rich in lime and nitrogen by the use of Rimpau's system of sand covering for arable land has quite gone out. The chief reasons against it are: the high technical development of meadow and pasture farming on moors of all kinds not treated with sand, the continued favourable economic situation for the disposal of animal products, the scarcity of agricultural labourers and the relatively high amount of labour for sanded arable cultivation (while meadows and pastures require so much less), and lastly the circumstance that the natural economic and personal conditions necessary for the successful execution of the intensive form of farming constituted by sanded moor cultivation are not frequently found.

The development of meadows and pastures on moors of all kinds, which is especially great on the true moors (Hochmoor) which have been less richly endowed by nature with plant food, depends mainly upon the following progress :

1) The recognition that, where water conditions are suitable, permanent grassland can be made to give heavy yields without recourse to the expensive use of sand as covering (fens) or for mixing with the surface (moors).

2) The improved methods of tillage, which induce a better physical condition of the soil, especially for new crops, by the use of more suitable implements (ploughs, harrows and disk harrows worked by animal or mechanical power). Among these, some rollers especially constructed for the work are very important ; they compress the soil after it has been

broken down to a good tilth, thus improving its capillarity to the benefit of the forage plants and affording a firmer footing to the stock at pasture. The regular use of heavy rollers has greatly contributed to the present development of pasturing on unsanded moor soil.

3) The extensive use of subsoil drainage in various forms (sod drains, lath, fascine, pole and tile drains with supports of laths, heather and the like under them to prevent sagging).

4) The exhaustive study of grasses on moor soils and of the life history of the most important meadow and pasture plants, which has led to the production of clover and grass mixtures suitable to the most various objects and localities.

The yields of properly laid down moor meadows and pastures are so satisfactory in all respects that they are equal to those of the best natural grasslands (1). By means of instruction on the part of the moor experiment institutions and commissions appointed for the purpose, of numerous model cultivations in which the association for the promotion of moor-cultivation in the German Empire has taken an active part, and of some large widely-known agricultural enterprises of this kind on moors and fens (East Friesian domain moors, Royal Schmolsin Estate), the knowledge of the methods and of the success obtained has spread everywhere and a satisfactory development of moor cultivation is taking place on all sides, especially in the old existing moor centres of north-west Germany.

Owing largely to the interest repeatedly shown by the German Emperor in the transactions on the promotion of moor-cultivation and on home colonisation in the Prussian Economic Council and in the German Council of Agriculture, interest has been satisfactorily awakened in all circles, especially in administrative and parliamentary ones, on the utilisation of the still existing large areas of moorland, especially as a field for colonisation. One effect of this is evidently the recent appropriation of greater means for moor cultivation and moor colonisation, through which some State moors are to be taken in hand and existing colonisation associations are to be assisted. Further, the Prussian agricultural administration has begun to institute special organisations for the object of utilising and cultivating moors (offices for moor and wasteland cultivation in the provinces including much moor), as well as to provide the necessary competent staff of officials by instituting courses on the cultivation of moors at the several institutions (Moor Experiment Station at Bremen, Moor Experiment Farm of the Pomeranian Chamber of Agriculture at Neu-Hammerstein in the Leba moor, Stolp district, Pomerania). The State and the Provinces have already set aside considerable sums, especially in aid of cooperative moor improvements.

(1) *Die Vsrsorgung Deutschlands mit Fleisch und die Kultivierung unsere Moore und Heideböden*, Memoir of the Association for the promotion of moor-cultivation in the German Empire. — *Denkschrift des Ministeriums für Landwirtschaft, Domänen und Forsten über die Moorkultur und Moorbesiedluug in Preussen*, 1912. — *Mitteilungen über die Arbeiten der Moor-Versuchs-Station in Bremen*, Report 5, 1913.

A law for the protection of moors, at present for the province of Hanover, but which it is hoped will be extended to other provinces including moors, is intended to prevent the destruction of valuable moors by the unsuitable extraction of peat.

Of special importance is the profit that the colonisation of the large moor tracts can draw from the progress of moor cultivation. The character of the farms in the new colonies is simple and safe, owing to the success attendant upon meadow and pasture farming on the moors ; not only can the colonisation of these waste lands considerably increase the home agricultural output, especially as regards animal produce, but the increase of small and medium-sized farms, such as are especially suitable for moors, represents an increase of the strength of the nation.

Recent Work of the Royal Entomological Station of Hungary

by

J. JABLONOWSKY,

Director of the Station.

I shall describe below the means of control employed by the Station in the course of 1913 against some parasites.

The corn ground beetle (*Zabrus tenebrioides* Goeze, *Z. gibbus* Fb). is in Hungary one of the most injurious insects. Its larvae injure the crops in autumn, attacking the cereal seedlings, and if the winter is mild they continue their ravages up to the beginning of May. In the month of June the insects devour during the night the grains of barley that are still in the milky stage. What steps can be taken to destroy this pest ? For the most part, the farmers excavate ditches in autumn or in spring round the infested fields, and this operation satisfies them, though the parasite is not destroyed by it. It has been known for a long time that in our country this insect becomes so injurious not only on account of the succession of the same cereals on the same soil, but also because in innumerable localities in Hungary wheat follows barley or is sown near the stubble of barley. The former practice may be avoided, but the second is often inevitable. Thus it becomes impossible to obtain by the above process any notable result.

In consequence of the experiments made in the autumn of 1912 in the neighbourhood of Nagykáta (at Szentmàrtonkáta, county of Pest), the Entomological Station has found an effective means of control of the corn ground beetle. A large estate of the neighbourhood, on passing into the hands of a new owner, fell into a deplorable condition in consequence of a change in the system of cultivation. The cereals sown in autumn, on an area of 1422 acres, showed before the beginning of winter the " spots " due to the beetle. The spraying of sulphate of nicotine with which we had experimented

the same year (1912) for the destruction of other pests soon produced an unexpectedly successful result: the "spots" that were treated did not spread in the following spring, because the larvae living on the ground had perished. We employed about 2 oz. of sulphate of nicotine and 1 ½ lb. of soft soap dissolved in 10 gallons of water. The spraying is performed with a common knapsack sprayer, and besides the "spots" the healthy plants for about a yard all round them are also treated. The earlier the spraying is done, the more effective is its action and the lower its cost.

The cereal or barley leaf beetle (*Lema melanopus*) is also included among the numerous insect pests of Hungary, but it does not cause injury to barley and oats except sporadically. The insect appears when these cereals, sown in the spring, are still tender, and it attacks their leaves. Nevertheless the mischief becomes serious only when the larvae hatch out of the eggs laid by the females on the leaves of barley and especially on those of oats; they then invade and devour all the leaves. The plants dry before the proper time and yield no seed, and even the haulms which are cut for straw are refused by the live stock, because the larvae, like those of other Criocera, secrete a viscous substance which moistens the surface of their bodies and with which they soil the haulm.

The means of control known in our country was devised about 18 years ago by one of the officials of the Entomological Station, Prof Sajó. It consisted in collecting the insects which appeared at the beginning of spring by means of a net or in spraying with tobacco extract (since 1892 known in Hungary under the name of Thanaton). Nevertheless these means of defence did not spread in our country, the causes being that in general no one attended much to the adult parasite; at most it was noticed in the later years of its ravages, and consequently no one used the nets. On the other hand the nicotine, the active principle of the juice, was not constant; the first tobacco extract, very active, contained 12 to 13 per cent. of nicotine, whilst later this content fell to 4 per cent. and even less. It is therefore not surprising that this insecticide has lost all credit.

In the course of the year 1913, we resumed the practice of catching the insect by means of nets, and instead of using the usual tobacco extract (Thanaton) we employed sulphate of nicotine. The insects were caught on an estate in the commune of Bokszeg (county of Arad). The result of the operation was satisfactory, inasmuch as on the fields where the net had been used the yield was about the average, while on the other areas it was less. It must, however, be mentioned that in 1913 this insect, owing to the rain which fell in May and June, did not commit the havoc it would have done if the weather had been dry and warm.

Spraying produced equally favourable results, though the rains of May and June rendered the work more difficult. The spraying was effected at Csála (near the town of Arad) in one of the State vineyards, using 4 lbs. of nicotine and 15 lbs. of soft soap to 100 gallons of water. A smaller quantity of nicotine was not equally efficient, while on the other hand a quantity greater than 4 lbs. per 100 galls. did not give any better results. The experiment succeeded perfectly, notwithstanding the fact that favourable weather,

that is not rainy, was rather rare. On the spots that were treated the larvae were completely destroyed, whilst where no treatment was applied they continued their depredations and then went through their metamorphosis.

This experiment made with the two systems offers farmers the possibility of controlling the pest in either way without being hindered by unfavourable weather.

Vine Caterpillars. — Similarly, other experiments were conducted on a larger scale with sulphate of nicotine against the caterpillars of *Conchylis ambiguella* and of *Polychrosis botrana,* which in Hungary (especially in the most valuable vineyards on sandy soils) cause as much injury as elsewhere. The experiments were conducted at Kecskemet (county of Pest) in the Miklós nursery (Miklós -Telep National School for Vine growers), and on a larger scale in the vineyard of the Royal Hungarian School of Agriculture at Jaszberény (county of Jasz-Nagykun-Szonok).

As a result of studies continued through a long series of years, the Entomological Station adopted the means of control which had succeeded especially in France, using sprays containing two ounces of nicotine (either sulphate of nicotine or the nicotine of the common extract) and 1 ½ lb. of soft soap to 10 gallons of water, or Dr. Jean Dufour's mixture composed of 1 ½ lb. of pyrethrum powder and 3 lbs. of soft soap to 10 gallons of water. Our system of control was thus similar to that employed elsewhere. As in 1913 the appearance of the larvae of *Conchylis* was reported on May 11, we began spraying ten days later. Instead of the Eclair Vermorel we used a sprayer mounted with an air pump working at a pressure of 4 or 5 atmospheres and provided with a forked rod bearing two nozzles, so that the two powerful cone-shaped jets strike the bunches on opposite sides at the same time. During the work we observed that on the vines treated at first there were still some larvae, while the bunches of the vines treated after the 24th and 25th of May were freed from 98 to 99 per cent. of them. The action of these liquid insecticides was very nearly the same, inasmuch as all the bunches treated either with nicotine or with pyrethrum powder were free from insects. Sometimes, however, the sulphate of nicotine proved the more effective. Between May 24 and June 8 the whole vineyard, about 43 acres, was treated, and there was still time to treat again the first plots (which had been treated between the 19th and the 24th of May) and which the caterpillars had not wholly abandoned. At the time when the vines were in bloom the vineyard was completely freed from caterpillars, which left scarcely any trace of their ravages.

These experiments have thus demonstrated that spraying gives a result of 98 to 99 per cent., provided the following conditions be observed: 1) that the control by means of liquid insecticides be commenced at the most favourable moment for the hatching of the caterpillars (in Hungary in 1913 it was after May 24); 2) that the spraying be carried out under great pressure; 3) that the bunches be sprayed on both sides; 4) that the solutions be composed of insecticidal substances (nicotine and pyrethrum) and of substances capable of removing fat (soap).

A complete destruction of the caterpillars is impossible, as on account of the continued appearance of the moths of *Polychrosis*, some caterpillars hatch out much later, and further the earlier ones do not attack the bunches of grapes but hide under the bark of the young shoots.

The results obtained by the experiments having been striking, our next task will consist in spreading the above method of destruction among the vine growers of the country.

Grape moth. — Among the other enemies of the vine we undertook experiments on a large scale against the caterpillars of the grape moth (*Tortrix pilleriana*). These caterpillars cause enormous injury, not only in the old vineyards of the mountainous districts and in those previously ravaged (as for instance at Versecz, county of Temes), but also in the vineyards on sandy soils, and the havoc caused reminds us of the times when they seriously threatened the French vineyards. In our country, in some vineyards, for instance at Sóstóhegy (near the town of Nyiregyháza, county of Szabolcs), where we carried out our largest experiments, the vine stocks after having been injured for three years in succession did not bear anything but slender shoots. Our experiments consisted partly in the destruction of the caterpillar at the beginning of spring, that is during the time in which the small caterpillar is still in the oldest part of the vine stock, and partly in control practised after burgeoning, when the caterpillar ascends on the shoots. The treatment before the shoots appeared proved completely inefficient. The two well-known processes of scalding and fumigating with sulphurous vapours were not employed. After the appearance of the shoots we had recourse to the treatment with tobacco juice until the caterpillars retreated to the extremity of the shoots, without however obtaining any encouraging results, the solution being unable to reach the caterpillar among the leaves. Instead of this treatment, we picked off the caterpillars by hand, nipping of the young shoots on which the caterpillars were crowded and collecting many of those scattered on the plants. Nevertheless the result was not complete. Although 150 or 200 caterpillars per vine had been collected, those on the ground or on the green hedge soon betook themselves to the vines that had been freed. In order to get rid of these we used a Bordeaux mixture to which half a pound of arsenate of lead had been added to every 10 gallons of liquid. We do not yet know what effect this treatment will have. In 1913 the result was not decisive.

Cockchafers. — The means of control used against the cockchafer (*Polyphylla fullo*) in the commune of Csongrád (county of Csongrád) have not yielded any decisive results. The larvae of this insect cause such havoc in the vineyards on sandy and very dry soils that not only are numerous old vineyards completely destroyed, but their reconstitution is rendered impossible because the larvae destroy the newly planted stocks. In order to control this pest the commune of Csongrád decided to have the insects picked by hand and to pay for them. Unfortunately in 1913 during harvest time the insect did not appear. It is not known if the extraordinarily cold weather and continued rain of 1913 was the cause of this, or if the insects did not swarm at all this year. Nevertheless, on grubbing in the sand, larvae

large and small were found, but no pupae or adult insects. At Kecskemét (county of Pest), situated near Csongrád, both larvae and insects were unearthed and swarming took place. The several thousands of insects that were picked have shown how future control is to be organized. Knowing the preference of this chafer for Scots pine (*Pinus sylvestris*), Corsican pine (*P. Laricio*), Austrian pine (*P. austriaca*) and black spruce (*Picea nigra*), I caused a railway-truckload of large pine branches to be brought from the Szeged pine forests and planted them in the sand of the Csongrád vineyards so that the needles remained fresh for some time. The great majority of the cockchafers were picked from these branches. It is therefore advisable henceforward to plant a greater number of these trees in our vineyards and to collect these insects regularly. This process will be easier and cheaper than picking them off fruit trees and poplars 50 or 60 feet high.

Rodents. — The diffusion of the means of control against rodents was another great undertaking. The Entomological Station, which deals also with the destruction of mammals injurious to fields and gardens, aims at rendering the control of voles, hamster rats and susliks (*Spermophilus citellus*) compulsory by law, and proposes : 1) that the operations of control be carried out every spring (from the middle of March to the middle of April), when the numbers, of the vermin are not yet large, and agricultural labourers can dispose of the necessary time ; 2) that against voles, flooding, traps (Hohenheim type) and carbon disulphide (5 grams per burrow) be used ; 3) that against susliks, 20 grams be used and against hamsters, 30 grams.

In the spring of 1913 the small commune of Kopesény (county of Moson) began the obligatory control; it was followed by the county of Szepes, and 5 communes of the county of Bereg on both banks of the Latorcza, in the control of susliks and hamsters. In these localities hamsters had for several years done much mischief in the maize and other grain fields, there being 40 to 60 burrows per acre. At first the small owners were sceptical as to the efficiency of carbon disulphide, but when after the second and third day of the treatment they observed that the hamster and suslik burrows remained closed and that on opening them only dead animals were found, all diffidence disappeared and they worked with zeal and care. It is very urgent to spread this method of control, especially against hamsters, which are extending and causing much injury in the communes of Sopron county, on the Austrian frontier.

Lime-sulphur mixture. — Lastly it must be mentioned that during the winter 1912-13 the Entomological Station occupied itself with propaganda for the use of lime-sulphur mixture, which is beginning to be known in Hungary. Notwithstanding the fact that this preparation is very effective against *Lecanium*, its spread in our country cannot be very rapid, because : 1) its preparation is lengthy ; 2) it does not always succeed on account of the varying nature of the different quicklimes of the country; 3) its preparation is not carried out on a large scale in Hungary nor at a low price. On the contrary the practice of spraying fruit trees in winter with carbolineum (15 lbs. of carbolineum to 10 gallons of water) is constantly gaining ground.

SECOND PART.

ABSTRACTS

AGRICULTURAL INTELLIGENCE

GENERAL INFORMATION.

DEVELOPMENT OF AGRICULTURE IN DIFFERENT COUNTRIES.

195 — **The Development of Agriculture in the German Colonies.** — WARBURG, O. in *Der Tropenpflanzer*, Year 18, No. 1, pp. 1-25. Berlin, January 1914.

The writer points out the increase in the exportation of agricultural produce from the German colonies during the last two years (1910-1912).

TABLE I. — *German East Africa.*

	Quantity — tons		Value — £	
	1910	1912	1910	1912
Sisal	7 114	16 810	147 600	360 700
Plantation rubber	406	1 036	161 300	300 950
Cotton	613	1 852	36 800	102 900
Coffee	980	1 551	41 050	93 250
Copra	5 254	4 174	93 500	76 600
Groundnuts	3 050	5 983	29 200	62 400
Sesame	802	1 852	11 800	25 600
Total	18 219	33 258	521 250	1 022 400

With the exception of copra, all the exports have increased, some even in enormous proportions (cotton 302 per cent.).

TABLE II. — *Kamerun.*

	Quantity — tons		Value — £	
	1910	1912	1910	1912
Plantation rubber	—	24	—	8 400
Elaeis kernels	13 473	15 737	174 100	215 900
Palm oil	3 091	3 538	61 750	81 450
Cacao	3 377	4 479	149 700	207 850
Total	19 941	23 778	385 550	513 600

Plantation rubber makes its appearance. The writer remarks that wild rubber has been badly hit by the present crisis.

TABLE III. — *Togo.*

	Quantity — tons		Value — £	
	1910	1912	1910	1912
Elaeis kernels	8 071	11 455	99 670	165 600
Palm oil	2 971	3 284	60 420	69 250
Cotton	463	542	22 350	25 250
Rubber	133	163	56 200	47 800
Maize	3 340	1 343	14 210	11 300
Copra	134	160	2 000	3 000
Cacao	135	279	4 700	11 900
Total	15 247	17 226	259 550	334 100

Maize is the only crop not showing an increase in exports.

TABLE IV. — *New Guinea.*
(*Including the Bismarck Archipelago and the Solomon Isles*).

	Quantity — tons		Value — £	
	1910	1912	1910	1912
Copra	9 094	11 193	148 800	198 550
Rubber	6	21	3 300	7 650
Cacao	39	73	2 700	3 700
Sisal	—	21	—	500
Total	9 139	11 308	154 800	210 400

The exports of the above four staples have increased, but only copra has real importance.

From the other islands of German Oceania agricultural exports have risen from £ 234 900 to £ 342 000.

On the whole, during the last two years agricultural exports have increased 25 per cent. in weight and 53 per cent in value.

With the progress of agriculture the spontaneous products diminish : wild rubber, copal, tannin and ivory. On the other hand, in Kamerun, kola nuts and karité are on the increase, as shown by the following figures :

	Quantity — tons		Value — £	
	1910	1912	1910	1912
Kola nuts.	54	234	880	8 180
Karité	66	105	250	640

The writer shows what progress has been accomplished by native farming. Out of the 54 000 acres planted to cotton in German East Africa, 38 500 acres were cultivated by natives. The progress achieved by German African cotton is mainly due to two causes : 1) the erection of ginning stations (37 in East Africa and 12 in Togo), principally by the " Kolonial-Wirtschaftlichen Komitee " ; 2) the institution of experiment stations for the study of diseases, methods of farming and varieties.

Among the oil seeds, besides sesame and groundnuts, the cultivation of which is developing, castor oil is grown in coconut plantations until the latter are in bearing, and it seems to give good results.

During the last few years, farming by Europeans has developed to an extraordinary degree. The chief plants grown are oil palms, tobacco and bananas.

The cultivation of oil palm has advanced thanks to the introduction of new methods, which allow four or five tons of fruit per day to be treated by only 16 or 20 hands, and the fat thus obtained is superior to that formerly produced.

At the end of this year there will be about 2 500 acres of bananas in East Africa, and steamers calculated to carry 50 000 bunches will ensure the rapid transport from Tiko to Hamburg.

The most interesting of recently introduced crops in Kamerun is tobacco. Some experiments have produced leaves for wrappers worth upwards of 3*s* 6*d* per lb. on the Bremen market, and some powerful companies have been formed. It must not, however, be forgotten that Kamerun planters will be in a state of inferiority to those of Sumatra as regards both transport and labour.

EDUCATION AND EXPERIMENTATION IN AGRICULTURE AND FORESTRY.

196 – **Grants for Agricultural Education and Research in England and Wales in the Year 1912-13.** (1). — *Board of Agriculture and Fisheries, Annual Report on the Distribution of Grants for Agricultural Education and Research in the Year* 1912-1913, pp. XXV + 132, London, 1913.

This report on the distribution of grants in aid of agricultural education and research gives first some information on the present organization of agricultural education in England and Wales (2). Then follow lists of the grants awarded to the various institutions, with indications as to the kind of work for which a grant is made, and of the grants awarded for the provision of technical advice for farmers and the investigation of local problems, as well as those for building and for miscellaneous purposes sanctioned by the Treasury from the Development Fund up to 31st March 1913.

The amounts are given below:

Grants in aid of Universities and University Colleges	£ 10 000
" " " " Agricultural Colleges	" 6 050
" " " " Special Institutions	" 2 800
" " " " Farm Schools	" 290
" " " " Agricultural Research Institutes	" 6 434
" " " " agricultural research and experiments	" 3 008
" for the provision of technical advice for farmers and the investigation of local problems	" 1 568
Total . . .	£ 30 150

Grants for buildings and for miscellaneour purposes from the Development Fund amount to £62 495.

The report contains also information on certain institutions in receipt of grants, notes on work at research institutes, research scholarships in agricultural science in the years 1911-12, the staffs of Universities and Agricultural Colleges in receipt of grants and the number of students (altogether 1165) attending course at Universities and University and Agricultural Colleges in receipt of grants, besides communications upon the organization of local schemes of agricultural education and advisory councils.

AGRICULTURAL SHOWS AND CONGRESSES.

197. – **Agricultural Shows.**

Australia.

1914. May 6 (opens). Hobart. — Inter-state fruit exhibition.
Aug. 11-16 Brisbane. — National exhibition.

Austria.

1914. May 16-21 Prague. — Annual Bohemian Agricultural Exhibition.
Sept. 7-12. Göritz. — Vine-growing and wine-making show, held on the occasion of the 9th Austrian Oenological Congress.

Dutch East Indies.

1914. Sept. 8-Oct 10. Batavia. — International rubber show.

(1) For 1911-12, see No. 452, *B.* May 1913. (*Ed.*).

(2) See No. 1018, *B.* Sept. 1913. (*Ed.*).

France.

1914. April 1-5. Nantes. — Poultry show organized by the "Syndicat des Aviculteurs de l'Ouest".

May. Epernay. — Agricultural, horticultural and vine-growing show, organized by the " Union agricole, horticole et viticole de la Marne ".

Oct 24-28. Cette — Federal horticultural show, organized by the " Federation horticole du Littoral "' (Hérault, Gard, Vaucluse, Bouches-du-Rhône).

Germany.

1914. May 15-21. Altona.—Great exhibition of horticulture, fruit and vegetables, organized by the city of Altona in commemoration of the 250 th anniversary of its foundation. Address to the Committee, 75 Flottbecker Chaussee, Altona.

Holland.

1914. July. The Hague. — Horse show. Sec. A. v. Hoboken, Nieuwe School-straat 27, The Hague.

Hungary.

1914. April 4-6. Budapest, Tattersall. — Thirtieth sale of breeding stock and show of agricultural machines and implements, organized by the National Agricultural Society of Hungary.

Russia.

1914. Governments of Kiev and Taurida. — Competition for agricultural machines. Reduced rates on Russian railways and free entry for machines taking part.

Spain.

1914. Autumn. Madrid. — International exhibition of agriculture and hygiene.

United Kingdom.

1914. May 19-21. London, Chelsea. — Royal Horticultural Society's spring show, at the Royal Hospital Gardens.

May 28-30 and June 1-2. Swansea. — Bath and West and Southern Counties Society's show. Sec. Thos. Plowman, 3 Pierrepont St., Bath.

June 10-13. Portsmouth, Southsea Common. — Royal Counties Agricultural Society's show. Sec. Franklin Simmons, Basingstoke.

June 30. - July 2. London, Kensington. — Royal Horticultural Society's summer show.

198. – **Agricultural Congresses.**

Dutch East Indies.

1914. Sept 7-12. Batavia. — International rubber congress.

France.

1914. July 20-22. Lyons. — International Vine-growing Congress, arranged by the vine-growers' society of the Lyons district in conjunction with the Permanent International Commission on Vine growing. The chief question will be vine mildew (*Plasmopara*).

CROPS AND CULTIVATION.

199 – **Distribution of Drought.** — *Communication from Professor* FILIPPO ERIDIA, *of the Central Bureau of Meteorology and Geodynamics, Rome.* AGRICULTURAL METEOROLOGY.

In Russia Professor Broounoff has been the means of starting studies on the effect of meteorological factors on the crops. The interesting results which he has obtained are such as to favour the general adoption of the Russian methods, especially in countries such as Italy where meteorological researches for the benefit of agriculture have been little followed.

As these methods are based on the climatic individuality of a particular region, their application necessitates a very thorough understanding of the climatic conditions, and quite possibly the methods may require alteration in certain details to make them of more value.

There exists for each plant what is known as the critical period, during which certain meteorological conditions are required. Plants should be adapted in such a way that they have their growing periods at a time when meteorological conditions are favourabale. A knowledge of the distribution of rainfall during short periods, of, say, ten days, considerably facilitates the choice of plants suitable for any given climate, but is not sufficient, since one cannot deduct from average data any conclusions as to the irregularities of the rainfall. Prof. Broounoff thinks that charts representing the distribution of drought would be useful in this respect, and he suggests for this purpose the term " dry ten-day periods ", by which he understands periods of ten days during which the total rainfall does not exceed 5 mm. (0.2 in.)

Charts of this kind already exist in Russia, based on rainfall data accumulated during at least 16 years and determinations of the frequency of drought of a certain ten-day period during a given number of years. By means of these values, reduced to one hundred years, Prof. Broounoff has arranged his charts so as to show the probability of the occurrence of drought. It is evident that these will be of the highest value in the parts of the year when rainfall is least ; but it is probable that what constitutes a dry ten-day period may need modification, since in certain regions where rain is absent during several months, the idea of drought would not appear to correspond to that which has guided Prof. Broounoff. This is the case in various parts of Italy, particularly in Sicily, where there are distinct rainy and dry seasons, though the rainy season often contains periods of drought or low rainfall. There is no doubt as to the value of knowing the minimum rainfall which will probably take place during a given ten-day period in any given locality, but I believe that more useful inferences could be drawn if the idea of a dry ten-day period could be replaced by a notation showing more clearly the occurrence of rain.

An examination of the ten-day periods with a total rainfall of 5 mm. (0.2 in.) shows that different values must be attached to them, according to the time of the year at which they occur ; that is to say, during periods of regular rainfall a ten-day period with a total of 5 mm. is really a dry period comparable to one having no influence on vegetation, whilst, on the other hand, if it occurred in a period of extreme dryness, *e. g.* during the summer months in Sicily, such a period could exercise considerable influence. It would appear, therefore, that the rainfall measurements would be more profitable if the probability of the period with low rainfall greater than 5 mm. were known, and also those of absolute drought. In the various observatories in Sicily, observations of the rainfall have been made during a considerable period, and it may be seen to what extent the ideas expressed above are of value for these regions.

		Frequency of ten-day periods with rainfall between 0.1 and 5 mm.											Frequency of ten-day periods without rain										
		Trapani	Palermo	Messina	Riposto	Catania	Siracusa	Mineo	Sortino	Giarratana	Caltanissetta	Girgenti	Trapani	Palermo	Messina	Riposto	Catania	Siracusa	Mineo	Sortino	Giarratana	Caltanissetta	Girgenti
September	1st	17	25	27	25	37	6	16	13	4	19	21	63	50	33	50	43	53	44	53	54	42	61
	2nd	23	32	30	12	13	16	16	23	12	23	17	30	22	10	31	40	31	32	33	38	38	52
	3rd	20	16	20	6	23	25	8	23	12	31	21	10	9	10	25	17	12	28	30	23	15	21
October	1st	23	19	13	31	19	25	16	17	7	18	28	10	0	3	16	13	6	32	28	18	11	7
	2nd	10	12	17	12	26	28	12	10	7	7	27	3	0	3	6	10	6	8	17	14	21	7
	3rd	13	12	3	34	26	22	20	14	14	11	14	7	3	3	9	13	6	16	10	14	18	17
November	1st	10	12	10	9	13	22	16	10	3	14	27	3	0	3	19	16	6	8	14	17	0	7
	2nd	23	9	7	12	10	22	16	23	7	7	7	7	3	0	16	3	12	12	3	14	7	10
	3rd	13	0	10	16	10	19	12	10	10	11	10	3	6	3	9	19	9	12	7	10	7	10
December	1st	13	6	3	16	16	9	8	7	7	22	4	0	0	0	9	6	9	0	10	3	0	4
	2nd	10	0	0	6	19	16	8	20	7	19	23	3	6	0	16	13	9	12	7	21	4	10
	3rd	7	12	0	31	26	19	8	10	3	19	7	0	0	0	0	10	3	4	3	0	4	4
January	1st	10	6	11	16	19	16	20	16	10	15	20	0	0	0	12	6	3	0	10	14	0	0
	2nd	13	3	4	16	13	12	14	13	17	22	21	3	3	7	9	16	9	8	7	7	0	14
	3r	10	19	7	19	16	19	16	16	7	12	14	7	3	7	6	10	3	8	3	10	4	10
February	1st	10	3	4	12	23	16	24	23	4	11	24	10	6	7	19	13	9	8	10	10	14	4
	2nd	27	6	0	9	16	19	12	10	21	18	21	3	3	7	9	6	3	8	7	7	0	14
	3rd	27	16	14	22	29	25	16	20	11	25	17	10	6	7	25	10	16	16	7	21	7	10
March	1st	23	3	3	9	42	28	20	30	17	13	17	7	6	0	22	6	6	8	7	4	13	7
	2nd	20	9	20	12	36	25	20	23	17	21	13	13	12	10	22	6	28	16	20	31	13	13
	3rd	23	12	7	16	26	34	24	23	0	31	10	7	3	0	22	16	9	4	13	24	17	20
April	1st	33	25	23	31	29	31	16	20	14	31	23	7	6	3	6	19	25	16	16	14	7	17
	2nd	20	19	17	19	32	44	32	27	10	29	27	13	0	3	28	10	12	4	16	21	14	17
	3rd	37	19	23	16	23	34	28	30	7	32	23	10	0	3	31	23	19	24	16	28	7	13
May	1st	23	34	27	28	39	44	44	38	26	34	40	17	6	7	31	26	31	24	28	30	25	33
	2nd	47	31	27	22	23	25	20	17	22	21	27	27	19	27	44	36	34	36	48	44	31	40
	3rd	30	19	10	16	19	16	24	14	11	33	27	33	22	20	34	23	34	24	31	30	13	37

The first part of the table given here contains numbers expressing the frequency during the period of observation of ten-day periods with not more than 5 mm. rainfall, reduced to a percentage number of years. Since the rainy season lasts from September to April and sometimes to May, we omit the indications relative to June, July and August.

In the first ten-days of January, the frequency of rainfall from 0.1 to 5 mm. is higher for the east and south slopes, the Tyrrhenian slope and centre showing only one half the figure. In the second ten-days the frequency is higher in the centre and the south slope and still continues high on the east side, while it is less on the Tyrrhenian side. The extreme west presents a higher frequency and is distinct from the conditions shown for the Tyrrhenian slope. In the third ten-days, the differences above indicated are much less, only very small local perculiarities being noticeable. During the three ten-day periods of February, the Tyrrhenian slope shows a minimum frequency in comparison with that of the other slopes, and the extreme west gradually approaches the conditions peculiar to the eastern slope, where on the contrary we meet with a higher frequency. The same conditions hold good for March, when, however, the centre and the lower part of the east slope show a higher frequency ; the interior and the extreme west come next in this respect, then the eastern and Tyrrhenian slopes. In April and May the frequencies are little different, except for the lesser frequency in the interior of the Syracuse region and on the upper eastern slope.

In September the frequency is greater for the Tyrrhenian slope and the middle and upper eastern slope, while elsewhere, especially in the interior of the Syracuse region, the frequency is less. In October the frequency becomes higher on the east and south slopes, and diminishes on the Tyrrhenian slope, in the Messina district and in the interior. This difference becomes less in November and December.

We have then various peculiarities appearing. The eastern slope has the greatest frequency of ten-day periods with a rainfall from 0.1 to 5 mm. in its central part, except in November, when on the contrary the greater frequency occurs in the lower part, whereas in the upper part the frequency is reduced in March. The Tyrrhenian slope, which may be made to include Messina, has in September a frequency approaching or slightly exceeding that of the eastern slope, while from October to March it remains lower. The central regions show conditions similar to those of the eastern slope in September; then they acquire the characteristics of the Tyrrhenian slope, losing them again in January. Finally, the southern slope follows the eastern slope from September to February and in March follows the Tyrrhenian slope.

In my opinion droughts in Sicily are best defined by the ten-day periods with complete absence of rain, and I believe that the frequency of these gives a better conception of the idea of drought expressed by M. Broounoff, especially as during the months of the rainy season a ten-day period with 5 mm. or less rainfall may be of some use to the crops, since the soil is already damp, whilst in the season of least rainfall such

quantities disappear without being of any use to the crops. Consequently, it would be of use to know the number of dry ten-day periods likely to occur, especially during the rainy season. For this reason the number of times each ten-day period has been dry has been given in the second part of the accompanying table, calculated on a hundred years. The first glance is sufficient to show the radical difference which manifests itself between the different slopes. From the first ten-days of October to the first of January, the Tyrrhenian slope appears very different from the eastern, for absence of rain has not been recorded or has been so rare that in the reduction to percentages it has been found impossible to express it by a value approaching unity. In the two other ten-day periods of January there is some slight correspondence, but the frequency on the east slope is greater and persists. The coastal regions and those of the eastern slope follow the conditions of the Tyrrhenian slope in December, but gradually this order approaches the conditions presented by the eastern slope.

It follows from what has been said that the character of the rainfall is better seen when to the figures for each ten-day period are added those defining the frequency of total rainfall between 0.1 and 5 mm. and of no rain at all.

It would certainly be useful to know the frequency of ten-day periods with a rainfall of from 5 to 10 mm. and also from 10 to 15 mm., since it is the minimum which decides the success or otherwise of the crop.

A conclusion which deserves consideration is that the farmers should know not only the mean quantity of rain, but also the frequency of the different quantities of rainfall for each ten-day period, if they are to derive from it the facts of fundamental value, since the quantity indicated each month has, by itself, only a limited importance.

200 – **On Seasons and Crops in the East of England.** — Shaw, W. N. (Meteorological Office, London) in *Journal of the Scottish Meteorological Society*, Vol. XVI, No. 30, pp. 179-183. Edinburgh, 1913.

A diagrammatic analysis of Mr. R. H. Hooker's paper « Correlation of the Weather and Crops », which appeared in the *Journal of the Royal Statistical Society* (Vol. LXX, pp. 1-51) in 1907. The diagrams present in a graphic form the extent of the correlation between the abnormalities of the crop and the abnormalities of rainfall and temperature, not only during the year in which the crop was actually grown but also during the preceding year.

The following conclusions are drawn as a result of the investigation: *wheat barley, oats* and *beans* all give the highest returns when the spring and early summer are moist and cool following on a warm midwinter, but while oats are unaffected by the character of the previous season, wheat, and to a less degree barley, are favoured by warmth and dryness in the preceding year, a dry autumn being specially important for wheat. Beans are less influenced by the temperature, but require a low rainfall in the summer and autumn of the previous year. *Peas* appear not to be dependent on abnormalities in the season.

Potatoes are exceptional in being favoured by cold and wet in the previous summer and autumn, and do best in a fine, warm growing season,

while *swedes* are favoured by a continuous abnormally low temperature lasting from the previous summer to the end of the growing season, and by rain in the early summer; *mangolds* require plenty of rain and cool weather in the early spring of the crop year.

Lastly, *hay* shows a striking preference for cool, wet weather in the harvest year, with a period of heavy rainfall in the middle of spring.

201 – **Correlation between Meteorological Conditions and Crops in the East of Scotland**. — WATT, A. in *Journal of the Scottish Meteorological Society*, Vol. XVI, No. 30, pp. 184-187. Edinburgh, 1913.

This article gives the coefficients of correlation between the yearly yields of potatoes and oats in Forfarshire (from the official statistics) and the monthly rainfall and temperature for the 26 years from 1886 to 1911. For oats, the coefficients of correlation between yield and rainfall are not significant, while a cool summer is distinctly favourable to the crop. The figures indicate that the largest yields of potatoes are obtained in hot, dry summers, low rainfall being particularly important.

202 – **The Composition of Rainwater Collected in the Hebrides and in Iceland.** – MILLER, N. H. J. (Rothamsted Experiment Station) in *Journal of the Scottish Meteorological Society*, Vol. XVI, No. 30, pp. 141-158. Edinburgh, 1913.

A historical sketch of observations on the composition and properties of rainwater and dew from early times, and an account of recent investigations on the nitrogen and chlorine content of rainwater collected at one point in Iceland, at one point in the West of Scotland, and at three points in the Hebrides lying to the north-west of Scottland — points remote from towns and having a very moist climate.

The amounts of ammonia, nitrate, and chlorine annually brought down by the rain are given below, together with analogous figures taken from the Rothamsted records.

	Rainfall inches	Lbs. per acre			
		Nitrogen			Chlorine
		As ammonia	As nitrate	Total	
Rothamsted	28.8	2.774	1.251	4.025	15.7
Vifilsstadir (Iceland)	38.3	0.802	0.263	1.065	(52.2)
Laudale (W. of. Scotland) . . .	76.9	2.784	1.260	4.044	168.5
Butt of Lewis (Hebrides). . . .	40.6	0.361	0.305	0.666	6 884.0
Monach » . . .	47.2	1.260	0.588	1.848	2 723.0
Barrahead » . . .	33.9	1.164	1.104	2.268	5 753.0

203 – **Rainfall as a Determinant of Soil Moisture**. — SHREVE, F. (The Desert Laboratory, Tucson, Arizona) in *The Plant World*, Vol. XVII, No. 1, pp. 0-26. Baltimore, Md., January 1914.

The influence of rainfall upon the distribution and seasonal activities of plants is obviously exerted chiefly through its power to replenish the

moisture of the soil. The desert regions of North America are characterised by a low rainfall which is chiefly made up of a large number of light rains and a small number of torrential rains accompanied by a heavy run-off. Thus in investigating the relation of rainfall to soil moisture in desert regions, it is necessary to determine the minimum amount of precipitation required to influence the soil moisture, and also to determine the durations of periods without significant rain in connection with the development of vegetation.

The present paper presents a digest of a short record of desert rainfall from Tucson, Arizona, interpreted in terms of its possible effect upon soil moisture; gives data showing the annual march of water content at three depths (3, 15 and 30 cm.) in a retentive clay soil; indicates the relative potency which different falls of rain were found to have in renewing the store of soil water; and estimates the relative efficiencies of various percentages of soil water for the maintenance of plant activity by correlating them with the current rates of aerial evaporation.

The average annual rainfall at the Desert Laboratory is 14.60 in., distributed in two rainy seasons of which the summer one lasting 63 days accounts for 54 per cent. of the annual precipitation. The average number of rainy days is 61.5 per annum, on 46.2 of which the rainfall is less than 0.25 in. In six years there were 32 days with more than 0.75 in. of rain, and they yielded 46 per cent. of the total rainfall in the six years. Finally, there have been periods of 140 days without rainfall of sufficient amount (0.15 in.) to affect the soil moisture.

The march of soil moisture during the year is closely related to the amounts of the significant falls of rain, the changes of moisture content being less transitive at the lower depths (15 cm. and 30 cm.) in the heavy clay soil investigated. The moisture at 3 cm. falls as low as 1 per cent., and that at 30 cm. rises to as much as 32 per cent. The average moisture of the soil from the surface to 30 cm. in the driest weeks of the year is 6.5 per cent., while in the wettest it is 29 per cent. At its minimum water content, the clay soil contains about one fourteenth of the annual supply of water furnished by the normal rainfall.

The weekly rate of atmospheric evaporation ranges from a minimum of 173 cc. to a maximum of 1084 cc. (the annual total being 31 447 cc.) in terms of loss from a porous cup atmometer. This is equivalent to a loss of 345 cc. per square centimetre from a free water surface. The ratio of evaporation to rainfall is as 9.3 to 1.

The ratio of evaporation to soil moisture fluctuates from a minimum to a maximum which are in the proportion of 1 to 10. At the foot of the Santa Catalina Mountains (3000 ft.), it is 9.7 times as large as at their summit (8000 ft.). The annual amplitude of moisture conditions at the Desert Laboratory is as great, therefore, as th t which exists in the most arid ortion of he year between localities which are 5000 vertical feet apart.

SOIL PHYSICS, CHEMISTRY AND MICROBIOLOGY.

204 – **Selective Adsorption by Soils.** — PARKER, E. G. (Bureau of Soils) in *Journal of Agricultural Research*, Vol. I, No. 3, pp. 179-188. Washington, D. C., December 10, 1913.

All phenomena connected with absorption are of the first importance in soil chemistry ; of these phenomena, while simple absorptive processes have been the subject of a considerable amount of research, such is not the case with adsorption phenomena (*i. e.* the property which a soil may possess of removing a dissolved substance, such as a salt, permanently from solution), and more especially with selective adsorption (*i. c.* the property of removing a constituent of a dissolved substance, such as the base or cation of a salt, from solution).

As the result of fi e series of experiments carried out with various soils, the writer reached the following conclusions :

Soils not only have the power of adsorbing dissolved salts from solutions, but also of adsorbing one ion at a greater rate than the other, or of adsoıbing selectively, to a marked extent.

The presence of bases of the soil (Ca, Mg, etc) in solution after shaking or lixiviating a soil with certain salt solutions is probably not due to a direct chemical reaction of the salt in solution with the silicates of the soil, but to a reaction of free acid, resulting from a selective adsorption of the cation, with the mineral components of the soil.

The rate of adsorption of chlorine ions from solution by soils is much slower than that of potassium ions. This selective adsorption of potassium by a soil from a potassium chloride solution increases with the concentration up to a certain point and then remains practically constant. On the other hand the percentage of potassium adsorbed from a potassium chloride solution increases as the concentration of the solution decreases, and at very low concentrations is practically complete. In general, too, the amount of potassium adsorbed from a solution of potassium chloride increases as the size of the soil particles decreases. In solutions of potassium chloride up to a strength of 37.5 gms. per litre, the presence of sodium nitrate decreases the adsorption of potassium ; above this concentration it increases adsorption ; but the presence of monocalcium phosphate has no appreciable effects on the adsorption.

Finally if a mineral fertilizer be applied to a soil and exposed to the rain and thus dissolved and carried through the soil in solution, these substances will be adsorbed either as a whole or selectively from the solution by the vast surface of the soil particles and will be held there by physical force until the plant removes them. The presence of other mineral substances added to the soil may or may not increase or decrease the rate at which this adsorptive phenomenon takes place.

205 – **Movement of Nitrates in the Soil.** — MALPEAUX, L. and LEFORT, G. (Ecole d'Agriculture du Pas-de-Calais) in *Annales de la Science Agronomique*, Year 30, No. 6, pp. 705-726. Paris, December 1913.

In a previous set of experiments (1), the writers showed that the movement of nitrates in the soil, caused by diffusion alone, was very slow, but that,

(1) See No. 109, *B*. Feb. 1913.

when caught by the evaporation current, nitrates may be brought up from deeper strata at a comparatively very rapid rate. Further, they showed that it was improbable that nitrate applied and ploughed in as an early spring dressing should be washed out of the soil even should the season prove a wet one.

During 1912 the experiments were continued. A piece of land was bastard trenched two spits deep, and divided into six plots which received the following treatment:

I. Control, received no nitrate.
II. Received 4 cwt. of sodium nitrate p. acre as a surface dressing.
III. » » » » buried 5 cm. deep.
IV. » » » » » 10 » »
V. » » » » » 1 spit (17 cm.) »
VI. » » » » » 2 spits (30 cm.) »

The nitrate was applied on April 12th, at which time the soil was in a good, workable condition, containing 14 per cent. of moisture. The plots were further divided right across the series, half of each being left uncropped while on the other half sugar beets were sown on April 18th. Throughout the season, at monthly intervals, the plots were sampled every 10 cm. to a depth of 40 cm., and analysed for nitrates by the Grandval-Lajoux method. A careful record was also kept of the rainfall.

I. *The Uncropped Soil* (Table I). The first sampling, which took place on April 5th showed that the soil in its natural condition contained about 1 mgm. of nitrogen as nitrate per 100 dry soil throughout the experimental zone and that the total nitrate content of the dressed plots was greater than that of the control plot by 6.5 to 7 mgm, of nitrogen per 100 dry soil, a figure which represents fairly accurately the calculated value of a dressing of 4 cwt. of sodium nitrate per acre. Between the first and second samplings only 1.1 in. of rain fell, and by May 16 there had occurred a rise of nitrate, chiefly noticeable in plots V and VI. The first half of June was very wet, and at the time of the third sampling (June 16th) the zone of maximum nitrate content had been washed from the top 10 cm. to the second 10 cm.; the third 10 cm. was also somewhat richer, but the rain had not washed the nitrates lower than this zone as the nitrate content of the fourth 10 cm. had remained practically stationary. A relatively dry period followed, and by July 16th the nitrates had clearly returned to the surface. This again was followed by a month of almost continuous rain during which 4.2 in. fell; yet, in spite of this abnormally wet period, the nitrates on August 16th were chiefly gathered in the second and third 10cm. layers; the fourth layer too was somewhat richer than before, but it would appear that no nitrates had been washed below this zone, as the totals remained practically the same as at the previous sampling.

The mean distribution of nitrates for the season (*i. e.* the mean of all the samplings at each depth and on each plot) shows considerable variation on the different plots. While in I it was almost constant throughout the 40 cm.; in II, III and IV the surface layer was considerably the richest;

Nitrate as mgm. of nitrog

Date of sampling	Rainfall in inches		Plot I Control, no nitrate					Plot II Nitrate spread on the surface				
			Depth of sample in cm.					Depth of sample in cm				
			0-10	10-20	20-30	30-40	Total	0-10	10-20	20-30	30-40	
TABLE I. — *Uncropped soil.*												
April 15	April 15-30 = 0.2 May 1-15 = 0.9	1.1	1.2	1.0	0.9	0.9	4.0	7.8	1.4	0.9	0.9	I
May 16	May 15-31 = 0.3 June 1-15 = 2.5	2.8	1.6	1.2	1.1	1.1	5.0	7.3	1.5	1.3	1.0	I
June 16	June 15-30 = 1.0 July 1-15 = 0.6	1.6	0.9	1.9	1.4	1.1	5.3	2.9	4.0	2.3	1.6	I
July 16	July 15-31 = 2.5 Aug. 1-15 = 1.7	4.2	2.2	0.9	1.2	1.3	5.6	4.0	3.6	2.0	1.5	I
August 16			1.2	1.3	2.3	1.5	6.3	2.0	3.8	3.6	1.8	I
Totals			7.1	6.3	6.9	5.9	—	24.0	14.3	10.1	6.8	-
Mean distribution			1.4	1.3	1.4	1.2	—	4.8	2.9	2.0	1.4	-
TABLE II. — *Soil under sugar-beets.*												
April 15	April 15-30 = 0.2 May 1-31 = 1.2	1.4	1.2	1.0	0.9	0.9	4.0	7.8	1 4	0.9	0.9	I
June 1	June 1-15 = 2.5 June 15-30 = 1.0	3.5	2.0	1.5	trace	1.0	4.5	6.8	1.7	1.1	1.0	I
July 1	July 1-15 = 0.6 July 15-31 = 2.5	3.1	1.0	1.0	1.4	1.2	4.6	2.4	3.2	2.0	1.6	
August 1	Aug. 1-15 = 1.7 Aug. 15-30 = 2.1	3.8	1.0	0.8	0.7	1.3	3.8	1.6	1.8	2.6	1.6	
August 30			0.9	0.7	0.7	0.9	3.2	1.5	2.5	1.7	1.2	

in V the second layer (10-20 cm.), where the nitrate had originally been buried, was richest, and the zone of distribution tended to increase; and in VI the most uniform distribution of all the dressed plots was obtained, without, however, any indication of loss of nitrate by washing down below the experimental zone.

II. *Soil under Sugar Beets* (Table II), The first sampling was the same as on the uncropped soil. The second sampling, on June 1st, after a fairly dry month, showed an accumulation of nitrate at the surface except in the case of plot VI, where the upward movement was nevertheless quite evident. At the third sampling the rains had washed the nitrates down to the second layer of 10 cm., and by August 1st the zone of maximum nitrate content was still deeper; but in this latter case the results were not so much due to

er 100 *dry soil.*

Plot III Nitrate buried 5 cm. deep.					Plot IV Nitrate buried 10 cm. deep.					Plot V Nitrate buried 17 cm. deep.					Plot VI Nitrate buried 30 cm. deep.				
Depth of sample in cm.					Depth of sample in cm.					Depth of sample in cm.					Depth of sample in cm.				
10	10-20	20-30	30-40	Total	0–10	10–20	20–30	30–40	Total	0–10	10–20	20–30	30–40	Total	0–10	10–20	20–30	30–40	Total
.0	1.9	1.1	0.6	10.6	6.8	2.5	1.0	0.9	11.2	1.6	5.8	2.8	0.7	10.9	1.2	1.8	4.9	2.6	10.5
3.2	1.8	1.1	1.0	12.1	7.0	2.0	1.5	0.9	11.4	4.0	4.0	2.0	1.3	11.3	3.0	2.1	3.2	2.8	11.1
.8	4.5	2.7	1.0	11.0	2.2	5.0	2.1	1.1	10.4	2.0	4.9	3.6	1.4	11.9	2.1	3.5	3.5	2.6	11.7
5.3	2.6	2.5	2.4	12.8	5.0	2.7	2.1	1.9	11.7	4.8	3.4	2.0	1.6	11.8	4.2	2.9	2.9	2.0	12.0
2.7	3.6	3.6	2.6	12.5	2.1	3.4	3.8	2.6	11.9	2.8	3.7	3.6	2.6	12.7	2.0	3.4	4.6	2.8	12.8
5.0	14.4	11.0	7.6	—	23.1	15.6	10.5	7.4	—	15.2	21.8	14.0	7.6	—	12.5	13.7	19.1	12.8	—
.2	2.9	2.2	1.5	—	4.6	3.1	2.1	1.5	—	3.0	4.4	2.8	1.5	—	2.5	2.7	3.8	2.5	—
.0	1.9	1.1	0.6	10.6	6.8	2.5	1.0	0.9	11.2	1.6	5.8	2.8	0.7	10.9	1.2	1.8	4.9	2.6	10,5
.6	2.4	1.2	1.1	12.3	5.5	2.8	1.4	1.4	11.1	4.6	3.6	1.7	1.0	10.9	2.8	2.6	3.3	2.6	11.2
.1	3.7	2.4	1.4	9.6	2.4	3.4	2.3	1.7	9.8	2.0	3.0	2.4	1.6	9,0	2.4	2.8	3.1	1.2	9.5
.7	1.8	2.2	1.7	7.4	1.4	1.7	2.6	1.6	7.3	1.5	1.8	3.4	1.2	7.9	1.4	2.1	2.1	2.0	7.6
.4	2.5	1.8	1.5	7.2	1.1	2.0	2.0	1.4	6.5	1.0	1.8	2.4	1.2	6.4	1.0	1.8	1.8	1.2	5.8

the washing by rain as to the depletion of the upper layers by the growing roots, the part played by the plant being indicated by the decreasing totals. The last sampling, on August 30th, showed a far more equal distribution of nitrates throughout the experimental zone than was obtained on the uncropped soil, owing to the fact that the influence of the rain is masked by the drying effect of the roots, which are at the same time reducing the nitrate content by absorption just where it would tend to accumulate.

The crop from the time of singling (end of June) onwards reflected distinctly the advantages of burying the nitrate; the differences became somewhat less marked towards the latter end of the season, yet the final weights when the roots were lifted at the end of October showed considerable differences in favour of the deeply sown nitrate.

Plot	Yield of sugar-beets p. aere. tons	cwt.
I Control	14	4
II. (surface dressing)	15	7
III. (5 cm. deep.)	16	8
IV. (10 » »)	17	0
V. (17 » »)	17	18
VI. (30 » »)	22	5

The whole investigation entirely confirms the conclusions previously drawn by the writer as to the necessity of applying nitrate for the beet crop early in the season, and of ploughing it in.

206 – **The Aluminium Reduction Method as Applied to the Determination of Nitrates in "Alkali" Soils.** — BURGESS, P. S. — *University of California Publications in Agricultural Sciences*, Vol. I, No. 4, pp. 51-62. Berkeley, California, May 1913.

The phenoldisolphonic method of determining nitrates in soil does not give satisfactory results where soluble salts are present, as in the case of "alkali" soils, and the following reduction method was tried as a substitute: 100 gms. of soil are mixed with 2 gms. of powdered quicklime and extracted with 200 cc. of distilled water. To 100 cc. of the extract 2 cc. of 50 per cent. caustic soda solution is added, and the liquid is reduced to half its bulk by boiling, in order to drive off ammonia. It is then washed into a large test tube fitted with a cork through which passes a bent glass tube drawn out into a point, a strip of aluminium foil is added, and the liquid is maintained at 20-22° C for 11 to 15 hours, after which the ammonia is distilled into $\frac{N}{10}$ acid. The method gave equally satisfactory results whether the soil contained large or small amounts of nitrates, or in the presence of "alkali" salts, neither was it less reliable when soluble organic materials such as soluble humus and dextrose were added to the soil.

207 – **Study of Hungarian Soils by Means of their Water Solutions.** – BALLENEGGER in *Földtam Köslöny*, Vol. XLIII, pp. 317-324. Budapest, 1913.

In the course of the autumn of 1912 the agricultural geologists of the Royal Hungarian Geological Institute of Budapest made a collection of the typical soils of Hungary, and the writer analysed the water solutions of 75 samples and determined electrical conductivity, at 18° C., alkalinity, dry residue before and after ignition, loss on ignition, mineral content, and especially the amounts of chlorine, lime and carbon dioxide. Besides, he determined the moisture of each sample.

The results of these analyses have shown that the water solutions may be used to characterise the various types of soils. Thus the grey forest soils contain the least amounts of soluble matter, their alkalinity and lime content are very low, while they are completely lacking in chlorine and carbon dioxide. On the other hand the brown forest soils give in general more concentrated water solutions.

In Hungary the most remarkable steppe soils are the chestnut-coloured and the dark brown ones. These are the most fertile of the Alföld, where they cover vast areas, especially in the angle formed by the rivers Tisza and Maros and in the southern part called Báeska. A characteristic feature of these soils is that the soluble substances and the alkalinity generally increase in the upper layers, then diminish to a minimum in the next layer, and increase again towards the subsoil.

In the Alföld there are vast areas of a black clay soil rich in humus, which was formerly the bottom of swamps and which drainage has now rendered cultivable. The distribution of soluble matter in these soils is the inverse of that of the chestnut and dark brown soils, but their content is much greater than that of the corresponding levels of the forest soils. Among these soils, the beginning of that accumulation of salts, which constitutes saline soils, is observed.

208 – **Quantitative Mineralogical Analysis of Sandy Soil.** — VENDL in *Földtani Közlöny*, Vol. XLIII, pp. 331-343. Budapest, 1913.

In order to determine the composition of a sand or of the sandy constituent of a soil, the methods hitherto employed were either complete chemical analysis or qualitative mineralogical analysis. The writer has succeeded in combining W. RETGER's method with microscopical and chemical analysis in such a way that he has been able to make a complete mineralogical analysis of the sand of the island of Csepel.

The process begins by separating the various minerals in very heavy solutions and fusions. According to their specific gravity, he separated the following groups of minerals

				Per cent
1)	2.5	to 2.6	Silica, potash-felspar	0.04
2)	2.6	» 2.7	Silica	71.38
3)	2.7	» 3.0	Carbonates, silica, micas	21,73
4)	3.0	» 3.3	Amphiboles	1.39
5)	3.3	» 3.6	Pyroxenes	0.45
6)	3.6	» 4.8	Garnets, rutile, zircon	0.84
7)	upwards of	4.8	Magnetite	0.14

With the aid of the microscope the various minerals of each group were determined, and by complete chemical analysis their quantity in each group. Thus the following quantities of the various minerals were found:

	Per cent
Silica	73.70
Potash-feldspar	2.40
Soda- »	3.28
Lime- »	1.85
Carbonates (total)	11.82
Micas	4.00
Apatite	0.04
Amphiboles	1.35
Pyroxenes	0.45
Rutile	0.01
Zircon	0.01
Magnetite	0.14
Garnet	0.70

209 – ***Bacillus radicicola* and Preparations for Soil Inoculation.** – MAKRINOH, I. in *Jurnal Opetnoi Agronomii*, Vol. XIV, No. 6, pp. 341-367. St. Petersburg, 1913.

The writer has subjected to bacteriological analysis the preparations for soil inoculation most widely distributed in Russia. At the same time he tested their effect on plant growth by means of pot cultures.

The bacteriological analyses showed that Kühn's liquid nitragin and Bottomley's nitrobacterine did not contain the specific organism, *Bacillus radicicola*, while Simon's " azotogen " and Kühn's " solid " nitragin contained about 50 per cent. of the bacillus amongst a mixed population of micro-organisms.

In the sand cultures the above preparations were compared with pure cultures of *Bacillus radicicola* and with fresh nodules. The best results were obtained with the pure cultures, while the " azotogen " and the nitragin, though less effective, gave satisfactory results. The nodules were least effective of all, but even in this case the plants attained a normal development.

210 – **The Toxicity of Soil to Cabbage after a Crop of Sesame.** — SKINNER J. J. in *The Plant World*, Vol. XVI, No. 12, pp. 342-346 + 1 fig. Baltimore, December 1913.

A sample of peat soil from Middle River, California, which had failed to grow cabbages after a crop of sesame, has been investigated by the writer. He found that a clear filtered aqueous extract of the soil had a distinctly injurious effect on water cultures of cabbage plants and to a much less extent on wheat. Treatment of the solution with finely divided carbon black appeared to remove the toxic effects (1).

A heavy oily body, semi-solid when cooled, was separated from the soil by extraction with hot alcohol. This oil is partly soluble in water, forming a solution which is very toxic to the growth of cabbage plants. The results of experiments with this substance are given in the following table :

	Cabbage		Wheat	
	green weight	relative	green weight	relative
Nutrient solution	3.36	100	4.50	100
» » + oily substance.	2.80	83	4.30	96
Distilled water	2.00	100	2.42	100
» » + oily substance.	1.75	88	2.35	97

Plots of the same soil on which no sesame had been grown produced good crops of cabbages. From these results it appears that a crop of sesame secretes substances toxic to cabbages, but not seriously injurious to wheat.

(1) Cf. No. 14, *B.* Jan. 1914. (*Ed.*).

211 – **Tobacco Stalks as a Fertilizer.** — HASKINS, H. D. in *Twenty-fifth Annual Report of the Massachusetts Agricultural Experiment Station*, Part II, pp. 80-84. Boston, 1913.

As the tobacco plant is a heavy feeder and is cut before the plant has a chance of developing its seed, it is obvious that a large quantity of fertilizing elements must remain in the stalks. Analysis of the latter yielded the following results:

Per cent of dry matter.

	Stalks from which the leaves were stripped:	
	I. after curing*	II. in a green condition**
Nitrogen	3.25	1.10
Potash	4.95	1.00
Phosphoric acid	0.78	0.26

* Havana Seed Leaf variety. — ** Another variety.

From statistics collected for Havanna Seed Leaf: 8666 plants are usually grown per acre, and the average weight of 10 stalks (stripped) is 6.58 lbs., that is 5 702 lbs. per acre. Assuming that the stalks contain 52.94 per cent. of water, the residue of dry matter produced would be 2684 lbs. per acre, containing the following amount of fertilizing material:

	lbs. per acre
Nitrogen	87.23
Potash	132.85
Phosphoric acid	20.94

Applying the commercial values usually assigned to such material in cotton seed meal or other organic manures, tobacco stalks would be worth about $ 24 per acre, or about $ 8.40 per ton of partially dried stalks (*i. e.* containing 50 to 53 per cent. of water).

Usually tobacco stalks are thrown out on the land in autumn, left exposed to the rain and snow during the winter, then gathered into heaps and burnt in the spring, the ashes being scattered over the land. Analyses of unexposed and leached stalks showed that only a little over 50 per cent. of the nitrogen was washed out during the winter, probably consisting of nitrates and the more soluble amide compounds; therefore the spring burning dissipates about 40 lbs. of nitrogen per acre, valued at $ 7, besides destroying a considerable amount of valuable organic matter. It is recommended that the practice be discontinued, and that the stalks be chopped up and buried.

212 – **On the Composition of Giant Kelps.** – MERZ, A. R. (Bureau of Soils, U. S. Department of Agriculture) in *The Journal of Industrial and Engineering Chemistry*, Vol. VI, No. 1, pp. 19-20. Easton, Pa., January 1914.

The data presented were obtained in the course of investigations directed by Dr. F. K. Cameron, of the Bureau of Soils, during the summer

of 1913, on the possibility of utilizing the beds of gant kelps on the Pacific coast as an economic source of potash salts (1).

The dry material was analysed according to the methods published by Turrentine (*Jour. of Ind. and Eng. Chem.*, IV, 431, 1912) and yielded the following results :

Seaweed	Total soluble salts	Potash	Ash	Iodine	Nitrogen
Alaria fistulosa . . .	15.16 to 32.30	2.27 to 13.07	4.41 to 15.08	—	2.05 to 15.08
Nereocystis sp. . . .	34.38 to 64.44	12.74 to 30.12	2.76 to 10.66	0 to 0.14	0.81 to 3.06
Macrocystis sp. . . .	19.46 to 45.76	6.92 to 22.48	4.07 to 6 92	0 to 0.30	1.08 to 2.69
Fucus sp.	17.24 to 17.52	3.48 to 3.51	4.48 to 5.44	—	1.18 to 5.21
Porphyra sp.	23.54	7.33	4.22	—	5.21

The results indicate that the *Nereocystis* of Alaskan waters is as important as that of more southern seas so far as the potash content is concerned. *Macrocystis* contains a lower percentage of potash than *Nereocistys* and *Alaria* is lower still, while *Fucus* and *Porphyra* are valueless for potash extraction on a commercial scale.

Another series of analyses carried out on *Macrocystis* sp. gathered at La Jolla, California, confirmed previous conclusions that freshly cut seaweed suffers no leaching effects from a short immersion in sea water.

As a certain amount of doubt exists as to the differences in composition between the laminae and stems of the seaweeds (2), the following analyses are of interest.

Seaweed	Part of plant	Parts per cent				Locality
		Potash	Total soluble salts	Ash	Nitrog.	
Nereocystis sp.	lam.	9.90	25.94	3.88	0.84	Alaska
	»	15.44	39.40	4.34	2.27	
	stem	28.26	52.88	3.60	1.06	
Postelsia palmaeformis . . .	stem	22.8	44.5	3.2	0.94	California
	lam.	9.7	29.7	4.3	1.40	
Macrocystis pyrifera. . . .	stem	18.7	40.3	5.3	1.24	California
	stem and lam.	12.4	28.3	6.9	1.04	

(1) See No. 1147, *B.* Aug. 1912. (*Ed.*)

(2) See CAMERON F. K. Kelp and other sources of Potash. — *Journal of the Franklin Institute*, CLXXVI, 364, 1913.

From these results and those of eight other samples analysed at the same time, the writer concludes that the nitrogen and the ash content are almost invariably larger in the leaves than in the stem of the same plant, and that the total soluble salts and the potash are more abundant in the stems than in the leaves.

213 – **Investigations on the Availability of Phosphatic Manures.** — JORDAN, W. H. (Studies in Plant Nuirition: I.) *New York Agricultural Experiment Station, Bulletin* No. 358, pp. 30. Geneva, N. Y., February 1913.

Manurial experiments were carried out with (*a*) superphosphate, (*b*) ground Florida rock (floats), (*c*) basic slag, (*d*) dehydrated Redonda phosphate, (*e*) bone meal, (*f*) iron ore waste. The plants were grown in cans and boxes containing either a poor sandy soil or a pure quartz sand, or a quartz sand to which 3 per cent. of sphagnum moss had been added, and all received in addition to the phosphatic manures other mineral salts to make the manure complete. Cereals, root crops and leguminous fodder crops were used as test plants.

The results point, in the first place, to the general conclusion that the availability of the phosphate is quite as much a matter of the kind of crop as of the form of combination of the phosphoric acid. Cruciferous crops (cabbage and rape) made use of the phosphoric acid in ground rock phophate without difficulty, while to the cereals (barley, millet and oats) it was practically useless. On the whole superphosphate produced the greatest amount of plant growth, though basic slag was not far behind. Redonda phosphate, though classed below the two above fertilizers, gave better results than ground Florida rock.

The influence of fineness on the availability of phosphates was investigated by using ground rock phosphate and bone meal of various degrees of fineness, varying from a fine powder such as " floats " (which will go through a bolting cloth) to a texture obtained by passing the manure through a sieve with 60 meshes to the inch. Three successive crops of rape obtained in 1899-1909 exhibited no increase with the more finely divided fertilizers, but when the experiments were repeated in 1903-1904 on a more favourable soil produced by the addition of sphagnum moss to the quartz sand, peas, barley and rape all assimilated increased quantities of phosphoric acid as the fineness of the fertilizing material increased, the amount of phosphoric acid yielded by the ground rock " floats " being almost twice as great as that yielded by the coarse material. In the case of bone meal the degree of fineness had much less effect. The proportion of phosphoric acid in the dry matter of the crop increased with the fineness of division of the ground rock, *i. e.* was proportional to its availability.

Manurial tests carried out with an iron ore waste containing 15.45 per cent. of phosphoric acid showed that it was of little use to barley ; the following table shows clearly how little adapted cereals are to utilizing the phosphoric acid of mineral phosphates before the latter have been chemically treated.

Relative availability of phosphoric acid from different sources as measured by chemical methods or shown by plant production (monocalcium phosphate taken for comparison).

Method of determining availability	Available phosphoric acid in:									
	Monocalcium phosphate		Iron ore waste		Basic slag		Ground Tennessee rock		Bone	
	gms	rel. wt.	gms	rel. wt.	gms	rel. wt.	gms	rel. wt.	gms	rel. wt.
1. Official U. S. A.	5.82	100	0.117	2.0	2.49	42.8	0.168	2.9	1.72	29.5
2. Wagner	5.82	100	0.195	3.3	5.13	88.1	1.25	21.5	5.07	87.1
	Dry matter produced by barley, less amount on checks									
Plant production	32.8	100	6.0	18.3	30.5	93.0	17.5	53.3	36.5	111.3

214 – **The Solubility of Mineral Phosphates in Citric Acid.** — ROBERTSON, G. S. in *Journal of the Society of Chemical Industry*, Vol. XXXIII, No. 1, pp. 9-11. London, January 15, 1914.

Quite recently artificial manure manufacturers have placed on the market large quantities of mineral rock phosphates as a suitable phosphatic manure. These rock phosphates, in spite of the fact that they are very finely ground, are only slightly soluble in 2 per cent. citric acid. They were therefore assumed to be of little use as an available manure compared with basic slag and bone meal, in which 80 to 95 per cent. of the phosphates are soluble in 2 per cent. citric acid... However, in a series of field trials carried out at Cockle Park (Northumberland) they gave excellent results on grass land, as will be seen from the following summary of the yields obtained:

Field Experiments on Three Years' Ley.

Manure	Number of plots	Total number of years	Average yield of hay per acre.
			cwt.
Slag (200 lbs P_2O_5 p. acre)	5	13	40.3
Bone Meal » »	2	5	39.7
Min. Phosphates » »	5	12	41.0
No Manure	2	5	35.2

With the object of finding a satisfactory explanation of the successful results obtained with rock phosphate, calcined and uncalcined samples of the Belgian and Tunisian varieties were subjected to 5 consecutive extractions in 2 per cent. citric acid, which showed that the rock phosphates are completely soluble in citric acid if enough of it be used and enough time spent on the extraction. The first extraction contained more lime than any other and the second and third gave the bulk of the phosphates. As the process rendering the phosphates soluble in the soil is a continuous one, these so-called " citric-insoluble phosphates " give as good results as the high citric-soluble slags, the citric acid test, as commonly performed, having given a test for lime content rather than phosphate content.

The cost of a unit of phosphate in rock phosphates is only about 9*d*, whilst in basic slag it is about 1*s* 4*d*. It will therefore be readily understood that the use of rock phosphates might prove of considerable economic importance.

215 – Influence of the State of Fineness of Superphosphate and of Basic Slag on their Efficiency. — MIKULOWSKI POMORSKI, J. (Mitteilung der agricultur-chemischen Versuchsstation in Dublany) in *Zeitschrift für das Landwirtschaftliche Versuchswesen in Oestereich*, Vol. XVI, No. 11-12, pp. 1044-1055. Vienna, November-December 1913.

From the time of Liebig it has been commonly held that fineness of texture is an important factor in the efficiency of superphosphate. The experiments of P. Wagner proved how essential was fineness in the case of basic slag, but there is altogether little experimental evidence on the subject, especially with regard to superphosphate; in order to investigate the matter further, two series of culture trials were carried out with oats. The plants were grown in jars containing 13 lbs. of a loess soil, deficient in phosphoric acid. For the first year's trials, the superphosphate and basic slag were mixed with 3 per cent. of gypsum used as a cement material, then pounded up and graded by means of sieves into particles of different sizes (0.5 - 1 mm., 1 - 1.5 mm., 1.5 - 2 mm.), while another portion of the mixture was again reduced to a powder. The second season superphosphate alone was tested ; it was cemented with agar and reduced to particles 0.5 cc. in size and to a fine powder. The manure was applied in the first series by mixing the dressing with the uppermost third of the soil in the jar, but in the second series the dressing was mixed with the entire contents of the jar. Further tests were carried out with the first series (consisting of 18 units of 3 jars each) on the effect of adding sodium nitrate and potassic salts ; while in the second series (consisting of 8 units) all jars received the additional nitrate and potash.

The results show that superphosphate cemented by gypsum to particles 2mm. in size, or treated with agar, is no less effectual than when in the condition of a fine powder ; in fact the samples treated with gypsum sometimes gave better results. The depth at which the manure was buried seemed of more importance than its degree of fineness. The phosphoric acid in basic slag, on the other hand, was less available when the manure had been treated with gypsum. From these results the following conclusions were drawn:

a) It is unnecessary to exact a great degree of fineness in superphosphate, as up to a certain point a rather coarse texture may be an advantage, amongst other reasons because it prevents pasting in the bags.

b) Superphosphate is far better adapted than basic slag for applying in the furrows together with the seeds at drilling time, as the pasting of the latter is likely to decrease its efficiency.

216 – **A New Fertilizer: Molassed Superphosphate (Superphosphat schlempe).** — STOLTZENBERG, H. in *Chemiker-Zeitung*, Year XXXVIII, No. 8, pp. 81-82. Cöthen, January 17, 1914.

The residues from the distillation of molasses were at one time thrown away, but they were soon recognised to be of manurial value as they contain nitrogen and potash, and were sold to farmers who applied them to such crops as mangolds, potatoes, tobacco and hops, though their sowewhat rapid decomposition and great bulk prevent their being used very extensively. Most of the sugar factories, however, concentrate and ignite their residues to recover the potash, or sell them in a concentrated condition to cyanamide works, which recover not only the potash but also 60 to 70 per cent. of the nitrogen as potassium cyanide and ammonium chloride. Even in these cases, 30 to 40 per cent. of the nitrogen and all the organic matter are lost, and for this reason efforts have repeatedly been made to transform these residues into a solid easily handled manure, either by drying the material or by mixing it with other substances. So far these efforts have proved unsuccessful, as the product has always been hygroscopic.

The reason for this is the presence in the residues of hygroscopic organic bases, more especially of betaine. Now Andrlik has shown that the acid phosphate of betaine is not hygroscopic, and the writer obtained a friable, non-hygroscopic product when he treated the concentrated residues from the molasses with a calculated amount of phosphoric acid and then dried the mixture. Better results still were obtained when the residues were mixed with superphosphate and the mixture heated for a short time at 108° C (226° F). The material thus prepared is friable, keeps well and is easy to apply. Molassed superphosphate obtained by mixing 3 parts of superphosphate with 2 ½ parts of concentrated residues contains 2.25 per cent. of nitrogen, 6.33 per cent. of potash and 11.53 per cent. of citrate-soluble phosphoric acid (8.48 per cent. water-soluble), and yields 57.32 per cent of residues on ignition consisting of soluble calcio-potassic phosphate, potassium and sodium sulphate and chloride, gypsum and non-decomposed phosphate from the superphosphate. The manure is made up of 50 per cent. of soluble substances and of 30 per cent. of undecomposed organic substance. If required, nitrate of soda, sulphate of ammonia or potash salts may be added in order to increase the nitrogen or potash content. The product does not damage sacks and has the avantage over other fertilizers of providing humus material as a basis for bacterial development in the soil.

Attempts to obtain analogous compounds, such as molassed slag or molassed cyanamide, with a preliminary treatment of the residues to render them non -hygroscopic, have not so far yielded practical results.

17 – **Secondary Constituents of Basic Slag.** — DEMOLON, A. and BROUET, G. (Station agronomique de l'Aisne) in *Journal d'Agriculture Pratique*, Vol. 138, No. 1, pp. 22-23. Paris, January 1, 1914.

A characteristic feature of present day investigations in soil fertility s the proposed use of fertilizing elements other than nitrogen, phosphorus and potassium, such as, for instance, manganese, boron, zinc, lithium, magnesium, fluorine, sulphur. The majority of agriculturists, however, have not yet been convinced of the utility of these elements in ordinary practice.

Basic slag contains not only phosphoric acid but also oxides of manganese and of magnesia, derived respectively from the ferromanganese introduced into the converters and from the linings of the converters themselves (see Table).

Analyses of Basic Slag carried out at the Experimental Station (Aisne).

Samples	Total Phosphoric acid	Manganese			Total Lime	Magnesia
		Total	sol. in 2% citric acid	sol. in 3% acetic acid		
1	17.40	5.54	1.84	1.47	—	—
2	18.87	4.72	1.84	1.21	43.00	16.41
3	15.23	4.72	2.27	1.11	—	—
4	18.20	4.55	1.61	0.94	—	—
5	17.65	5.34	3.59	1.27	45.19	3.24
6	17.80	5.16	2.77	1.30	—	—
7	17.78	4.72	1.98	1.16	44.80	10.14
8	18.60	5.20	1.50	1.06	—	4.50
9	18.16	4.07	1.64	1.08	—	13.86
10	18.80	4.21	2.67	1.47	—	—
11	15.35	3.93	2.77	1.44	—	—
Mixture of 10 other different samples . .	—	4.10	3.59	2.68	48.02	10.05

The above analyses show that the manganese content of basic slag is fairly constant and in the neighbourhood of 4 to 5 per cent., while its solubility in citric acid indicates that it is present in a condition available to plants. An application of 6 parts of slag would be equivalent to 2 parts of manganised lime, so that if manganese plays a useful role in plant nutrition it cannot be lacking where slag is employed as a manure. The magnesia content of slag is more variable, averaging about 10 per cent.; the lime-magnesia ratio, however, usually remains within the optimum limits laid down by plant physiologists. An application of 5 parts of slag would be equivalent to 1 part of lime-magnesia manure such as is now on the market.

218 – **Distribution of Manure in Drills: Results obtained in Experiments o Barley and Sugar Beets at Hatvan, Hungary, in 1912** (1). — JANCSÓ, BÉL in *Kisérletügyi Közlemények*, Vol. XVI, Part 6, pp. 758-776. Budapest, November-De cember 1913.

Considering the great interest recently shown by Hungarian farmer in the question of distributing manures in drills, and the widely spread us of mixed drills for seed and manure built by several agricultural machin manufacturers, the National Society of Hungarian Agriculturists (Országos Magyar Gazdasági Egyesület) resolved, at the beginning of 1912, to exhibi such machines of various makes, with the object of examining them from a technical point of view and of determining their value by actual experi ments.

The plan of these experiments, conducted on the estate belonging t the Hatvan sugar factory, was drawn up by the Royal Agricultural Experi ment Station of Magyaróvár, which was besides entrusted with the exe cution and supervision of the trials and with the examination of the material tested.

Experiments with spring barley. — These experiments were carried out by five distributors of various systems, but owing to the too frequent rain the barley lodged, especially on the plots manured with chemicals. The yields of the various plots were nearly the same and no decisive result could be arrived at. Nevertheless it was seen that a moderate dose o superphosphate and nitrate of soda given in drills has no ill effect on the germination of the seed, and rather hastens the first development of the young plants.

Sugar beets. — The experiments with beets, carried out on the same plan, were more successful. Each of the five machines had to work upon 6 plots, each 1.42 acres in extent, and manured as follows :

Plots	1 and	4	No manure
»	2 »	5	186 lbs. of super and 46 lbs. of nitrate spread broadcast, over the whole surface.
»	3 »	6	93 lbs. of super and 23 lbs. of nitrate in drills.

The machines worked on the 15th and 16th of April.

Observations showed that manuring in drills acts better on the deve lopment of sugar beets than manure broadcasted, and its benefits were visible throughout the whole period of growth. On October 7 samples were taken from all the plots ; in the sugar content no great differences were noticeable, but as to the size of the beets there was a difference in weight in favour of manuring in drills. In the experiments the average weights were :

	Series of plots I gram	Series of plots II grams
Without manure	321	321
Manure broadcasted	371	373
Manure in drills	398	395

(1) See also Original Article by C. KERPELY in *B.* Nov. 1913, p. 1696. (*Ed.*).

The yields per acre averaged as follows:

	Series of plots		Average	Surplus over control plot
	I	II		
	lbs.	lbs.	lbs.	lbs.
Without manure, control . . .	17 492	17 450	17 470	—
186 lbs. super and 46 lbs. nitrate, broadcasted	18 703	18 233	18 468	998
93 lbs. super and 23 lbs. nirate, drilled	19 751	19 406	19 578	2 107

From the above table it will be seen that half the dressing drilled gave a surplus over the control plot more than double that obtained by the whole dose when broadcasted. It must also be mentioned that the sugar beets were affected by the great drought of July and August, without which the yield would have been much heavier.

That the drilled manure produced a better result than twice the dose spread broadcast might be explained by the supposition that the soil of the Hatvan estate, being rich in humus and well cultivated, did not require a greater amount of manure. According to this view the use of a larger quantity of manure broadcasted, the effect of which would be slower but more durable, should have proved more advantageous on poor and badly cultivated soils. But during the course of the experiments this objection was completely removed, quite by chance. The extremities of the experiment plots were formed by a piece of exhausted land belonging to an adjacent estate, which had been only recently rented. As all the plots ended in this land the development of the beets could be observed. Here also the results of manuring in drills were striking throughout the whole time from the germination of the seed to the time of lifting.

	Series of plots I	II
	grams	grams
No manure	117	100
Manure broadcasted	174	186
Manure drilled	226	223

It appears from the above figures that in exhausted soils the drilled manure was more active than twice the amount broadcasted, for while the latter yielded nearly twice as much as the check plot, the former yielded nearly three times as much, as is shown by the following figures per acre :

	Series of plots		Average	Surplus over control plot
	I	II		
	lbs.	lbs.	lbs.	lbs
Without manure, control	3 445	3 411	3 428	—
Broadcasted manure	6 740	6 678	6 709	3 281
Drilled manure	9 375	9 362	9 368	5 940

The Hatvan estate having found that drilling manure is more advantageous than broadcasting it, has definitely adopted the former method for all the crops.

219 – **Manurial Experiments in Palestine.** — *Les Mercuriales Agricoles*, Vol. III. No. 94, pp. 36-39. Antwerp, January 16, 1914.

The following data are taken from the report of Dr. Keller, director of the agricultural school at Wilhelma (near Jaffa), on manurial experiments carried out in 1912-13. They show what an important part fertilizers will be called upon to play in the production of agricultural crops in that country.

Up to the present, fertilizers have only been used by the German colonists, and by native cultivators immediately surrounding the German colonies. Manurial trials have now yielded sufficient data for practical conclusions to be drawn ; it is quite evident that only fertilizers increase the returns, as dung, which in Palestine consists of refuse from ruined villages, does not give the same good results. With suitable dressings of fertilizers, yields amounting to 25 bushels of wheat or barley per acre were obtained, and though these will certainly be further increased eventually, they already represent a distinct advance on the yields of native cultivators, who generally harvest no more than twice the amount of grain originally sown as seed. With the increased fertility of the soil its feeding capacity has also increased and whereas previously 11 acres were considered necessary per head of cattle, now less than 5 acres are deemed sufficient, and sales of dairy produce rose from £1680 in 1910 to £3360 in 1912.

With regard to the manures used, sulphate of ammonia has been almost exclusively employed as a source of nitrogen, because the importation of nitrate of soda was prohibited up to 1910, but the price of the former has now risen to such a height that it will be replaced more profitably by nitrate. Phosphoric acid in the form of superphosphate, and 40 per cent. potash salts are the other most suitable manures. For cereals the following dressing is recommended :

4 to 5 cwt. superphosphate per acre
2 to 4 » potash salts per acre
1 » nitrate of soda (as a top dressing)

This would cost 37*s*. to 39*s*. per acre.

Manurial trials with sesame and maize have only given negative results so far, possibly because the manures were applied too late in the season when there was not sufficient moisture in the soil to dissolve them properly.

The following results were obtained in 1912-1913 on a heavy clay soil which has been in cultivation 8 years and which had received a dressing of dung in 1906.

Crop yields per acre.

Crop	No manure		1½ cwt. nitrate per acre		1½ cwt. nitrate 6 cwt. superphosphate per acre		1½ cwt. nitrate 6 cwt. superphosphate 3 cwt. potash salts per acre	
	tons	cwt.	tons	cwt.	tons	cwt.	tons	cwt.
Oats and vetches . .	1	17	3	3	3	19	4	9
Beans		10		—		14		15
Mangolds	11	5	18	0	23	0	26	11
Cabbage	4	8		—	16	8		—
Beet root	1	0		—		—	10	16

220 – **The Minimum of Plant Food required for Maximum Production.** — JORDAN, W. H. Studies in Plant Nutrition: II. — *New York Agricultura Experiment Station, Bulletin* No. 360, pp. 53-77 + 8 figs. Geneva, N. Y., February 1913.

AGRICULTURAL BOTANY. CHEMISTRY AND PHYSIOLOGY OF PLANTS.

These experiments were devised with a view to ascertaining the essential minimum amount of available phosphoric acid and potash required to produce maximum growth. The crops used included barley, peas, tomatoes, tobacco, buckwheat, rape and turnips.

Two sets of cultures contained all the required elements except phosphoric acid and potash respectively, one of these elements being added in progressive quantities to the several cultures of each set. The conditions of temperature and moisture were under control and were as far as possible regulated so as to fully satisfy the requirements of the plants throughout the experiments. The results obtained show considerable uniformity amongst the different crops.

No fixed relation exists between the production of dry matter and the amounts of phosphorus and potash utilised. Up to a somewhat indefinite point the production of plant substance increased in most cases with increase in the supply of the variable constituent, but beyond that point increase in the consumption of both phosphorus and potassium compounds only resulted in an increase in the proportion of phosphorus and potassium in the plant tissues and not to a corresponding increase of plant growth.

The results also confirm the conclusion that the chemical analysis of a given crop is no certain criterion of the manurial requirements of that particular crop.

221 – **The Use of Radium as a Means of Forcing Plants.** — MOLISCH, H. in *Die Naturwissenschaft*, Year II, Part 5, pp. 104-106 + 3 plates. Berlin, January 1913.

The writer has, for more than two winters, investigated the effect upon resting portions of plants of solid radium emanations. The budding of branches of lilac (*Syringa vulgaris*), for instance, was accelerated by the effect of radium, provided they were exposed to its influence at the right season (end of November and in December), and not for too long or too short a time, one or two days being sufficient. Unless these conditions are observed, the preparations had either no effect or a harmful one upon the buds.

The experiments with emanations, which produce a more equal effect upon the buds than can be obtained by the use of solid preparations, were attended with very good results. The longer the emanations lasted (20, 48, 72 hours) the greater was their effect.

Not all plants, however, can be forced by radium. The experiment has at present no practical value, since the same effect can be produced by the use of simpler and less costly means.

222 – **Phosphoric Substances in Meadow Hay.** — DUSERRE, M. C. (CHAVAN, P. and TSCHUMY, L.) in *Archives des Sciences Physiques et Naturelles*, Year CXVIII, Vol. XXXVI, No. 12, pp. 578-581. Geneva, December 15, 1913.

Phosphorus compounds being of great importance in animal economy, the writers investigated the compounds of that nature contained in meadow hay. They distinguished three groups of compounds :

1) *Phosphatides*, consisting chiefly of lecithins and extracted by boiling alcohol.

2) *Phosphates*, soluble in dilute acids, together with *phytin* which decomposes into phosphoric acid and inosite.

3) *Nucleo-proteids* or proteins, insoluble in the above reagents.

Various samples of hay from different meadows were examined and their phosphorus content was distributed as follows :

	I	II			III
		1910	1911	1912	
	per cent	per cent.	per cent.	per cent.	per cent.
Phosphorus in the form of:					
Lecithins	4.0	4.0	7.8	6.8	6.3
Phosphates and phytins. . . .	54.3	55.8	62.1	61.1	54.3
Nucleo-proteids	41.7	40.2	30.1	32.1	38.4

These results show that more than half the phosphorus in hay is present in the form of phosphates and phytins, and that 30 to 40 per cent. is in the form of nucleo-proteids, while the amount in the form of lecithins is less than 10 per cent.

The application of phosphatic manures to meadows increases the phosphorus content of the hay, more especially that part present in the form of phosphates and phytin, as shown in the following tables.

	I			II		
	Yield of hay per acre	Phosphorus		Yield of hay per acre	Phosphorus	
		per cent. in hay	lbs. per acre		per cent. in hay	lbs. per acre
	cwt.			cwt.		
Unmanured	19.9	0.108	2.41	11.9	0.157	2.09
Superphosphate. . .	20.3	0.191	4.73	24.3	0.235	6.40
Potassic super . . .	29.4	0.199	6.55	31.9	0.233	7.96

Assuming that lecithins and nucleo-proteids have a mean phosphorus content of 4 per cent. and 5 per cent. respectively, and that all the phosphorus extracted by dilute acids be in the form of phytin, the production per acre of the various groups of phosphorus compounds was:

	II			III		
	Lecithin	Phytin	Nucleo-proteids	Lecithin	Phytin	Nucleo-proteids
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
Unmanured	4.10	5.64	15.79	3.52	4.39	16.02
Superphosphate . .	6.11	13.38	20.02	9.32	15.21	41.16
Potassic super . . .	8.47	18.38	28.44	17.62	17.33	54.73

The application of phosphatic manures to meadow land, supplemented when required by potassic and nitrogenous fertilizers, therefore increases considerably the amount of phosphatic compounds produced on a given area, the forage being not only more abundant but also richer, and permitting more intensive feeding of the grass land.

PLANT BREEDING.

23 – **Characters of the Grain in Varieties of Hungarian Pedigree Wheat and their Hereditary Transmission.** — OBERMAYER, ERNÖ in *Köztelek*, Year 23, No. 93, pp. 3133-3134. Budapest, November 29, 1913.

The writer gives an illustrated description of the grains of the pure types obtained by pedigree selection of the Diószag and Somogy Hungarian beardless wheats, and demonstrates that the various forms selected from the same variety differ not only in their development and in the morphological peculiarities of the plants, but also in the character of their grain. In order to determine these differences, the writer discusses the visible variations of form of the seeds (long, short, etc.): he shows that though the size (weight) and colour of the grain are subject to some change according

to the seasons, these characters, and still more the form of the grain, show uniformity in all the descendants of each of the pedigree types and are transmitted pure. The hereditary transmission of the characters of seeds was determined according to the examination of the crops harvested in 1910, 1911 and 1912.

224 – **Increase of the Productivity of Hungarian Wheat by Means of Selection.** — GRABNER, EMILE in *Köztelek*, Year 23, No. 99, pp. 3331-3333. Budapest, December 24, 1913.

The productivity of Hungarian wheat not being susceptible of increase by the development of its tillering, on account of the consequent late ripening, the writer recommends the selection of ears bearing three or four grains per spikelet, instead of the two usual in Hungarian wheats. Among the pure types obtained by the selection of Hungarian wheat (effected at the Hungarian Station for Plant Selection), and the characters of which differ essentially, there are several which answer to the above requirements. Notwithstanding the climatic conditions during flowering time, frequently injurious to pollination, the spikelets of these selected types are distinguished by a large number of grains: three and four, rarely five, in which case they are very small.

225 – **A Many-eared Variety of Maize obtained by Selection in Hungary.** — GRABNER, EMILE in *Gazdasági Lapok*, No. 51, p. 850. Budapest, 1913.

In 1911 the seeds of 25 ears of Pignoletto maize taken from plants bearing four ears, selected in 1910, were sown in the experiment fields of the Royal Hungarian Institute for Plant Selection at Magyaróvár. The numbers of stalks obtained in 1912 are shown in Table I.

The parent ears classed in the first and second groups are the descendants of two of the ears of a stalk bearing four ears selected in 1910, whilst the third group comprises the descendants of the two other ears of the same stalk.

In 1913 the seeds from the stalks with 7 and 12 ears mentioned in table I were sown; whilst in the plants of the 1912 harvest the majority of ears did not grow directly on the main stalk but on the longer side shoots, in the 1913 crops as well as in the parent plant of the first selection (1910) the stalks bore the ears directly on the main shoot.

The hereditary transmission of the number of ears on the 1913 crops is shown in Table II.

TABLE I.

Number of ears on the stalk	No. of parent ear																								
	1st group									2nd group							3rd group								
	I	II	III	IV	V	VI	VII	VIII	IX	I	II	III	IV	V	VI	VII	I	II	III	IV	V	VI	VII	VIII	IX
I	8	4	11	11	11	12	18	13	12	13	21	20	12	8	20	14	7	20	20	11	17	10	18	1	14
2	39	34	27	29	20	31	29	31	31	30	24	25	18	28	26	26	34	25	24	23	21	34	23	41	20
3	3	10	4	9	10	10	7	9	11	10	9	4	14	9	4	4	7	5	7	10	9	8	5	8	11
4	—	2	2	3	5	1	2	3	5	3	3	—	6	1	3	1	4	2	3	4	2	3	2	5	8
7	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—
12	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—

NB. The Arabic figures in the various columns represent the number of stalks obtained.

TABLE II

Number of ears on the stalk	Parent plant with 7 ears						with 12 ears			
	I	II	III	IV	V	VI	I	II	III	IV
1	8	6	20	9	4	5	13	21	14	19
2	10	24	34	33	11	15	14	7	9	6
3	14	13	14	9	9	1	4	2	—	2
4	7	10	4	4	—	—	—	1	—	—
5	1	2	2	1	—	—	—	—	—	—
6	5	—	—	—	—	—	—	—	—	—
7	—	—	—	—	—	—	—	—	—	—
	1	—	1	—	—	—	—	—	—	—

The yield of stalks obtained from the ears no I. of the parent stalk with 7 years shows the excess of stalks bearing more numerous ears over those bearing one or two ears.

Average yield of whole ears.

	grams
Stalk with 1 ear	81.3
» » 2 »	128.4
» » 3 »	182.5
» » 4 »	220.8
» » 5 »	253.6
» » 6 »	247.8
» » 8 »	189.7

The much lower yield of the stalk bearing 8 ears is due to the fact that 4 of the ears remained sterile.

226 – **Plant Breeding and Selection in New Zealand.** — GREEN, A. W. in *New Zealand Department of Agriculture, Journal of Agriculture*, Vol. VII, No. 5, pp. 482-487. Wellington, November 1913.

Selection experiments are in progress with all the more important farm crops, fruits and vegetables. The main object at present is the isolation of disease-resistant forms. Up to the present time, success has been achieved in the production of a new rust-resistant variety of oats (known as Ruakura Rust-resistant) from a single head selected in 1908. Over 100 acres are now under this crop at Ruakura alone, and some 220 farmers have received free samples.

227 – **Cultivation Experiments with Loose-Eared Varieties of Winter Wheat.**— MUNDT, L. in *Arbeiten der Deutschen Landwirtschafts-Gesellschaft*, Part 248. Berlin, 1913. CEREAL AND PULSE CROPS.

In this publication, the writer gives a summary and account of the results of the experiments carried out with loose-eared varieties of winter wheat by the German Agricultural Society (Deutsche Landwirtschafts-Gesellschaft) in the years 1908-1910. The experiments extended throughout Germany, which is divided into 12 cultural districts. In 1908, 25 reports were sent in; the number of experimenters rose in 1909 to 37, and in 1910 to 43.

These experiments are of the greatest importance to the experimenter, since thereby he ascertains, in the simplest and surest manner, the varieties which are most suitable to his farm. They are also of great general importance, for they are carried out in the most different districts of Germany and under the most various conditions of soil, climate and cultivation, and are thus valuable as a means of ascertaining the characteristics of the different varieties.

The experiments described by the writer are partly principal experiments, and partly preliminary trials of new varieties. In the principal experiments the following wheats were grown for comparison: Orig. Rimpau's Hybrid, Orig. Criewener 104, and East Prussian Epp.

Considering only the thoroughly reliable experiments, the following average yields of grain (in lbs. per acre) were obtained:

	Rimpau's Hybrid	Criewener 104	E. Prussian Epp
1908	2936	2545	2523
1909	2246	2402	2181
1910	2086	2237	1976

It is thus seen that Rimpau gave the highest yield in 1908 and Criewener in the other two years. As regards straw yield and duration of growth there is little difference between the three varieties; the same may be said in respect to resistance to disease. As the winters during which the experiments were made happened to be very mild, little can be said as to the capacity of these wheats for withstanding cold; the most resistant was, on the average, the East Prussian Epp wheat. Criewener 104 takes the first place as regards resistance to lodging, the worst being East Prussian Epp. With respect to the flintiness of the grain, Rimpau's Hybrid was far superior to the two others; this, together with its higher gluten content, is the best evidence that it will produce the finest flour for bread making.

Preliminary experiments were carried out in these years with eight other varieties. A final decision as to their value cannot yet be made; for this, further and more extensive experiments are necessary.

228 – **Studies on the Stem-Anatomy of Wheat and its bearing on Classification.** — BLARINGHEM, L. and MIÈGE, E. in *Comptes-Rendus Hebdomadaires des Séances de l'Académie des Sciences*, Vol. 157, No. 25, pp. 1457-1460. Paris, December 22, 1913.

The classification of the varieties of wheat belonging to the species *vulgare, compactum, dicoccum, turgidum*, etc., has not yet been satisfactorily achieved. In spite of numerous attempts at classification by various authorities, considerable doubt remains as to the actual value of the various subdivisions. With a view to throwing some light on these difficulties, the writer has made an anatomical study of the stems of numerous varieties of wheat.

He finds that:

1) The differentiation of the tissues increases in passing down the stem and is more pronounced in winter than in spring wheats. This differentiation consists in a thickening of the cell walls, an increase in the number and size of the vascular bundles, and a wider distribution of them, naturally associated with a thicker stem.

2) The anatomical structure of the stems of *T. spelta*, *T. durum* and *T. monococcum* is very uniform and distinct, especially with regard to the number, dimensions and distribution of the vascular bundles.

3) The stem structure of *T. vulgare*, *T. dicoccum* and *T. turgidum* is far from constant; various strains of them show affinity in this respect with the above-mentioned species.

4) Hybrids between *T. monococcum* and *T. durum* have the stem characters of *T. dicoccum*, and crosses of *vulgare* × *turgidum* resemble *spelta* and *durum* wheats.

Thus it would appear that such polymorphic species as *dicoccum*, *turgidum* and *vulgare* have originated as hybrids. These results also support Naudin's theory, according to which the stem structure of hybrid wheats would be a heterogeneous and unstable mosaic of characters occurring in a stable form and inherited without change in the forms *spelta*, *durum* and *monococcum*.

229 – **Observations on some Characters of Hard and Tender Barleys.** — VINE, H. C. A. in *The Journal of the Institute of Brewing*, Vol. XIX (Vol. X. N. S.), No. 6, pp. 413-452 + 3 plates. London, October 1913.

With a view to extending our knowledge of the factors causing "steeliness" or "hardness" in barley, the writer has made a detailed histological examination of numerous grains of hard and soft or mealy barley from different harvests and different countries. It has long been known that harvests unfavourable to the proper maturation of the grain give rise to a greater percentage of hard grains of inferior malting quality. This inferiority has been chiefly attributed to the condition of the gluten and the nitrogen content of the grain.

The writer's investigations show that among other factors the following are very important: 1) the condition of the cell walls of the endosperm, and 2) the size of the starch granules.

By means of suitable staining and microchemical tests he has shown:

1. That the cell walls of the endosperm consist of resistant laminae uni-

ted by more plastic layers, and that the disintegration of these laminae by the enzymes during the process of malting and brewing is more difficult and much less complete in hard than in tender ones.

2. That the proportion of small or rudimentary starch granules is much higher in hard than in tender barleys; these small granules, owing to the presence of an intact outer covering or cellulose envelope, are much more resistant to the action of enzymes, moisture and temperature than the mature granules of normal size.

Further investigations are being made concerning the percentage of phosphoric acid.

230 – **Eight Years' Cultivation Experiments with Beans.** — ZIFFER, A. *Arbeiten der Deutschen Landwirtschafts-Gesellschaft*, Part 249. Berlin, 1913.

This paper is the first detailed report on the results of experiments in the cultivation of several varieties of horse beans conducted by the German Agricultural Society (Deutsche Landwirtschafts-Gesellschaft), in cooperation with other bodies, from 1905 to 1912. The experiments were carried out on a uniform plan and as they extended all over Germany and under the most varied soil, climatic and economic conditions, they are of the greatest importance for forming an opinion as to the merits of the different varieties. The writer discusses, in the introduction, the principles according to which the experiments were conducted; he further gives a sketch of the weather conditions during the years that the experiment lasted, and an exhaustive description of the different varieties tried.

The experiments were divided into preliminary and main experiments. In the years 1905 only the former were carried out and with the following varieties: Eckendorf, Small Thuringian, Halberstadt and Dutch Marsh beans. During these preliminary experiments the Small Thuringians were three times first as to yield and may be considered as the most productive; the second place was occupied by the Halberstadt beans and the third by the Eckendorf. The yields of the Dutch marsh beans varied very much and did not allow of any reliable conclusions being drawn.

On the basis of these preliminary trials the varieties selected for the main experment during the period 1906-08 were the Eckendorf, the Small Thuringian and the Dutch marsh beans. According to these experiments the Eckendorf and the Small Thuringian seem to have the same value as to productivity under favourable conditions of growth. The Small Thuringians require less water than the others and therefore thrive better in dry years and on dry soils. Under less favourable conditions the Dutch marsh bean is a valuable variety, at least equal to the Eckendorf, and superior to the Small Thuringian.

The Halberstadt bean was substituted for the Dutch marsh bean in the main experiment during the years 1909-12. The results of this period agree with those of the previous one, inasmuch as the Small Thuringians in dry years prove superior to the Eckendorf beans. The Halberstadt have revealed themselves as fairly productive, but require more moisture than the Small Thuringians. The yields of the several varieties, as well as those

of each year and the averages for both periods of experiment, are collected in tables. As the value of a variety does not depend only upon the yield, but also upon other useful characters such as the composition of the crop, and resistance to plant diseases and to lodging, observations on these qualities also were made during both experiments. With the help of these results any farmer can easily find out which are the most suitable varieties for his farm.

Together with the determination of the agricultural value of the several varieties, experiments were also made as to the effect of sulphate of copper against leaf aphids. As an appendix, a table containing results of this treatment on the yields of grain and straw of several kinds of beans is attached to the report. On the Eckendorf, Dutch and native seeds the copper sulphate treatment was injurious to the yield of pulse and of straw, in all cases. With the Small Thuringians and Halberstadts the yield was in some instances higher than on the plots which had not been treated.

231 – **The Tepary, a New Cultivated Legume from the South-West States.** — FREEMAN, G. F. in *The Botanical Gazette*, Vol. LVI, No. 5, pp. 395-417 + figs. 1-11. Chicago, November 1913.

The writer describes a new bean occurring in the south-west of the United States. On account of its resemblance to *Phaseolus acutifolius* Gray and its larger dimensions he proposes to call it *P. acutifolius* var. *latifolius*. It is grown by the Indians and Spanish settlers throughout Arizona and northern Sonora and is noted for its drought-resistant qualities. The seed has a high specific gravity (1.33) and absorbs moisture very rapidly, thus enabling it to germinate during the short periods of rainfall of arid climates. It yields a gelatinous extract in water and is much prized by Mexicans and Indians in the preparation of soups.

ROOT CROPS.

232 – **Mutations of Tuberous Species of *Solanum* produced under Cultivation** (1). — HECKEL, E. and VERNE, C. in *Bulletin des Séances de la Société Nationale d'Agriculture de France*, Vol. LXXIII, No. 8, pp. 612-628. Paris, October 1913.

This article is an account of the results obtained in culture experiments with several tuberous species of *Solanum* collected by Claude Verne in the Cordillera (Chile, Peru, Bolivia) in 1911. The experiments were conducted at the Botanic Gardens of Marseilles and Montpellier and in horticultural establishments at Gières and St. Martin d'Uriage.

The following species gave rise to mutations under cultivation.

Solanum immite. — The mutants consist of round yellow tubers of good appearance, which develop early, producing a haulm of a distinct type, resistant to *Phytophthora*.

S. Jamesii. — This species resisted the effects of good cultivation for three years, but later with heavy dressings of poultry manure produced a new kind of tuber, yellow in colour, round in shape, with soft flesh and

(1) See also: No. 2560, *B.* Aug.-Sept.-Oct. 1911; No. 68, *B.* Jan. 1912; Nos. 23 and 24, *B.* Jan. 1913; No. 655, *B.* June 1913. (*Ed.*).

without prominent lenticels. No change has taken place in the characters of the haulm, since they agree with the description given by Baker in 1884.

S. tuberosum. — This species responds very readily to treatment and gave rise to mutations in both tubers and haulm in the first years. Plants grown from tubers from different sources (Bolivia and Peru) have been described by Bitter as belonging to two new species, *viz. S. acaule* and *S. medians.* The author agrees with Weddel and Dunal in regarding the former as an alpine form of *S. tuberosum* and as a result of his experiments proposes to describe it as var. *caulescens.* This subspecies shows great promise. It produces a luxuriant haulm of a height of 3 feet or more and during a severe outbreak of *Phytophthora* when all types of *S. Commersoni* and *S. Maglia* and the wild *S. Bitteri* were badly attacked, this species remained perfectly healthy during August and September, in spite of warm rainy weather.

S. Maglia. — Incomplete mutation took place in this species. Numerous tubers were produced of a deep violet colour with streaks of yellow. A considerable shortening of the stolon took place, and in some the lenticels were less prominent.

S. Commersoni. — Five tubers of a new type were obtained at Montpellier. They were of a greyish yellow colour and produced plants more resistant to *Phytophthora.* Samples were exhibited at the show of the " Société viticole et horticole du Beaujolais ", at Villefranche-sur-Saône, in August, and they appear to have entered into cultivation in this district.

S. Bitteri. — This species shows little tendency to produce mutations. Transplanting it from Marseilles to St. Martin d'Uriage appeared to have no effect on the stability of its characters. Some of its tubers have shown a slight tendency to form areas with fewer lenticels. The tubers are yellow on lifting, but turn a deep violet colour on exposure to the air.

The writer does not agree with the theory that *S. tuberosum* is the only possible origin of the cultivated potatoes of the world, nor with the belief of many botanists that the numerous wild tuberous species of *Solanum* are incapable of the cultural modifications undergone by the ordinary cultivated species.

233 - **The Artificial Ripening of Cotton.** — *The Textile World Record*, Vol. XLVI, No. 3, pp. 64-65. Boston, December 1913. FIBRE CROPS

The question of ripening is one of the most important in the cultivation of cotton. An American inventor seems to have found a process for ripening cotton by artificial means, which would allow all the bolls being gathered at one picking. L. De Costa Ward, of the Philadelphia Textile School, has tested bolls matured naturally and others artificially by the Hall process. They showed practically the same length of staple in both cases, with the artificially matured fibres possessing greater strength. The seed from the bolls was tested by M. J. Williams, Government chemist, who reports that the oil and fat in the artificially ripened seeds was 2.32 per cent. higher than in the naturally ripened ones.

234 – **Experiments in Hungary with Hemp Seed from Asia Minor and from Italy.** — GASZNER, KÁROLY in *Köztelek*, Year 24, No. 4, p. 84. Budapest, January 10, 1914.

During the last three years the writer has conducted a series of comparative experiments with two varieties of hemp: one from Turkey-in-Asia, the other from Italy (Bologna). Of both varieties 62 lbs. per acre were sown in rows $4\,^3/_4$ inches apart on several fields of 57 to 72 acres in area. The two varieties were sown at the same time and under similar conditions. In the Asiatic variety germination began 8 or 9 days after sowing, in the Italian 2 to 3 days later. The Asiatic hemp showed a more rapid development than the Italian, its stalk became thinner and more flexible and at the approach of flowering time it turned light green, whilst the Italian hemp kept its dark green colour to the end. On August 1, at the beginning of the harvest, the Asiatic hemp was about 6 inches taller than the Italian and in spots where the soil was most suitable it attained 10 feet in height. The result obtained from the two varieties showed also some difference: in 1912 the crop of Asiatic stalks was 186 lbs. per acre in excess of the Italian, and in 1913, 288 lbs. (The average quantity of hemp harvested in 1912 was above 83 cwt. per acre). The difference in the yield of the two varieties may be attributed to the denser germination of the Asiatic hemp.

From these experiments the writer draws the conclusion that for the soils of Hungary, Asiatic hemp is more suitable. Its stalk becomes taller and it yields a finer and longer fibre, more suitable for the textile industry than the Italian variety. Nevertheless, the Asiatic seed has not yet been selected, as attention has only recently been paid to it. This is a task for the recently created Royal Hungarian Institute for the Cultivation of Flax and Hemp.

OIL CROPS

235 – **Some New or Little-known Oil Seeds and Oils.** — *Bulletin of the Imperial Institute*, Vol. XI, No. 4, pp. 559-574. London, October-December 1913.

Safflower (*Carthamus tinctorius* L.) has been grown experimentally in Nyasaland; a sample of its seeds received for examination was quite similar to the Indian safflower seed of commerce. It yielded 29.6 per cent. of oil. Submitted to valuation by experts it was reported about equal in value to the Indian seed.

Amoora Rohituka W. and A. (Meliaceae) is found in Northern and Eastern Bengal and Assam. The seeds yielded 42.5 per cent. of a viscous clear yellow-brown oil, with an unpleasant smell and bitter taste. On examination it gave the following results:

Specific gravity at $\frac{15.5^0\ C}{15.5^0\ C}$		0.930
Solidifying point of fatty acids		32.4° C
Acid value		24.7
Saponification value		192.3
Iodine value	*per cent.*	131.7

This oil could be used for soap making, but its flavour and acidity render it unsuitable for edible use. The residual cake would be useless for

feeding cattle on account of its taste, and of very little value as manure. In April 1913 the seed was valued at about £ 9 per ton in the United Kingdom.

Eruca sativa Mill., is a Crucifer extensively cultivated in India. The seeds examined yielded 30.8 per cent. of clear yellow oil with a slightly mustard-like smell and taste. The following are the results on examination :

Specific gravity $\frac{15.5^{\circ}\ C}{15.5^{\circ}\ C}$		0.915
Acid value		2.4
Saponification value		175.7
Iodine value	*per cent.*	101.6

This oil could probably be used for the same purposes as rape and colza oils.

Samples of Calophyllum Inophyllum seeds and kernels from India yielded from 55 to 71.4 per cent. of oil according to the drier or moister condition of the samples. The oil is viscous, greenish yellow, semi-solid at ordinary temperatures. The results of examination were the following :

Specific gravity $\frac{100^{\circ}\ C}{15.5^{\circ}\ C}$		0.880
Solidifying point of fatty acids		36.3° C
Acid value		45. 9 to 77.5
Iodine value	*per cent.*	93.1 to 97.7
Saponification value		192.8 to 202.9

The oil is of excellent quality for soap making, but would be useless for edible purposes if the acid value were as high as in the present samples ; if the fresh seeds or kernels were shipped and handled quickly this might perhaps be avoided. In April 1913 the kernels were valued at £ 16 per ton in the United Kingdom. The residual cake, probably only suitable for manure, might be worth about £ 2 per ton.

Kernels of *Mesua ferrea* seeds from India yielded 75 to 76 per cent. of oil, corresponding to 46 to 49 per cent. from the whole seed. The constants of the oil were as follows :

Specific gravity $\frac{100^{\circ}\ C}{15.5^{\circ}\ C}$		0.932
Solidifying point of fatty acids		30.5° C
Acid value		16.2
Saponification value		204.9
Iodine value	*per cent.*	92.2

This oil could be used for burning or lubricating and probably for soap or candle manufacture. It appears that the cake cannot be utilized as a feeding stuff. It would be preferable to export the kernels and not the entire seeds, as the shells are of no commercial value and only increase the

cost of transport. The kernels are worth £ 17 to £ 18 per ton in the United Kingdom.

Illipe oil from the kernels of *Bassia latifolia* from Mauritins differs somewhat from that from Indian kernels, but it yields a good hard yellow soap and for this purpose could realise about the same price as good palm oil.

Pentadesma butyracea is known as " butter or tallow tree " in Sierra Leone. Kernels from the Gold Coast and from Southern Nigeria showed very unequal quality. Consequently, for exportation, only mature kernels should be collected and they should be thoroughly dried in the sun before being shipped. The fat is stated to be highly coloured and to need refining before it can be used to advantage in soap making. The kernels would probably be worth £ 8 to £ 10 per ton in the United Kingdom.

236 – **Some New Tropical Oil Seeds.** – HEBERT, A. in *Journal d'Agriculture tropicale*, Year 13, No. 150, pp. 358-362. Paris, December 1913.

West Africa. — The fruits of *Pentadesma leucantha* A. Chev. contain 5 to 10 ovoid seeds each weighing about 20 grams. These seeds, when crushed and treated with benzine, yield about 50 per cent. of a fatty substance, the constants of which have not yet been determined.

An undetermined species of *Carapa* (Meliaceae) produces a seed containing a kernel weighing about 5 gms. and about two-thirds of the whole seed. These crushed kernels yield, on extraction by benzine, 38 per cent. of fat ; this is yellowish white, and melts at 21° C. Its density when melted is 0.913 and its constants correspond to those of a slightly drying oil ; owing to its advantageous yields, it might be put to the same uses as most of the vegetable butters.

The fruits of *Sorindeia oleosa* A. Chev. contain in their kernel a browinish fat ; its density is 0.889 at 17° C. ; it melts between 16 and 17° C. and resolidifies between 12 and 13° C; its constants approach those of oils possessing a certain degree of drying properties, and it could be utilized.

The kernel of *Lophira procera* represents about 75 per cent. of the seeds, which average 0.83 gm. each ; these kernels yield more than 55 per cent. of a consistent cream-coloured fat, which is especially suitable for the manufacture of soap. The seeds of *Lophira alata* yield less (40 per cent.) of a similar fat. The cakes are not utilizable as food for live stock on account of their bitter and astringent taste. For the manufacture of soap this fat is said to be equal in value to palm oil.

Madagascar. — Two Clusiaceae, *Symphonia leavis* and *S. Louveli*, studied by MM. Jumelle and Perrier de la Bathie, yield seeds containing a certain proportion (35 to 40 per cent.) of a dark yellow fat, of pasty consistence; its density is between 0.872 and 0.879 at 20° C. and it melts at 15 to 16° C. Its high oleic acid content (60 per cent.) indicates its possible use in the manufacture of soap, and the high melting point (55° C.) of the mixture of solid acids renders it suitable for stearine works. These seeds thus present much interest from the point of view of their industrial utilization. Unfortunately the number of trees which produce them tends to diminish in consequence of the continuous deforestation of the eastern slope of Madagascar.

237 - ***Acrocomia sclerocarpa* and Gru-Gru Oil** (1). — KNAPP, A. W. in *The Journal of the Society of Chemical Industry*, Vol. XXXIII, No. 1, p. 9. London, January 15, 1914.

The writer describes *Acrocomia sclerocarpa* as a tree belonging to the coconut palm family. Its trunk is generally swollen in the middle and has circles of sharp spines at intervals, thus making it impossible to climb. The leaflets are thinner than those of the coconut palm and the leaves are said to possess a very delicate fibre. The fruits are oblate spheroid in shape, about the size of a large plum and dark green in colour. The skin is very tough, but if the fruits are allowed to fall to the ground, this rots off, leaving the nuts behind, the kernels remaining sweet. The shell of the nut is about $^1/_8$ inch thick and hard ; the kernel ($^5/_8$ inch across) has the appearance and flavour of coconut, but is tougher and more transparent.

Fruit: length 1 ½ inch, breadth 1 $^3/_4$ inch, weight 30 gms., pericarp 59.73 %, shell 31.30 %, kernel 8.97 %. The pulp of the pericarp yields 2.44 per cent. of dry ether extract.

The kernel contains :

	per cent.
Fat (petroleum-ether extract)	49.13
Water	8.14
Albuminoids	13.70
Fibre and unestimated	29.03
	100.00

One tree bore nine large bunches, each containing about 400 fruits. The kernels were collected in March and on pressing when hot yielded an oil having the following properties (table, p. 364).

The writer concludes that this oil is identical withMocaya oil of Paraguay and the oil from the maccasuba palm of Surinam. It is very similar to coconut and palm-kernel oils in both organoleptic and analytical tests, consisting chiefly of laurin and myristin. It contains about 12 per cent. more olein than coconut oil, and hence should have about the same value as palm-kernel oil. Its soap is almost white and has excellent lathering properties, while the " stearine " should make a good edible fat.

Though the tree is widely distributed in the West Indies and South America, and appears to grow on the poorest soils, large quantities of the kernels and oil are difficult to obtain.

(1) See also No. 28, *B.* Jan. 1914. (*Ed.*)

	Oil	Insoluble fatty acids
Colour	very pale yellow	white
Odour	like coconut oil	like coconut fatty acids
Taste	ditto	ditto
Specific Gravity $\left(\frac{99^{\circ}\ C.}{15.5^{\circ}\ C.}\right)$	0.861	0.838
Melting point	26.0° C	24.0° C
Titer	—	23.05° C
Iodine value (Wijs)	19.4	20.3
Refraction at 40° C.	36.95	19.7
Saponification value	243.5	—
Reichert-Meissl value	7.2	—
Polenske value	13.9	—
Shrewsbury and Knapp value	163.0	—
Neutralisation value	—	261.9
Mean molecular weight	—	214
Free fatty acids (as oleic)	0.62 %	—

238 – **Baobab Fruits and Seeds from the East African Protectorate.** — *Bulletin of the Imperial Institute*, Vol. XI, No. 4, pp. 583-586. London, October-December 1913.

The low oil content of baobab seeds does not allow them to be exported to Europe, but they can be used on the spot as food for live stock by softening the integument by boiling. They contain 3.5 per cent. of mineral matter, and their ash, which is rich in potash (31. per cent.) and in phosphorus pentoxide (34.2 per cent.), may be utilized as manure.

The husk of the fruit may be used as fuel, and its ash is a rich potash manure (47 per cent. of potash).

Though the pulp contains a certain amount of free citric acid, the extraction of this is not remunerative on account of the presence of a good deal of pectic substances. The pulp does not seem to be utilizable beyond the colony, where it is used to coagulate rubber.

239 – **Contribution to the Study of *Hibiscus cannabinus* L.** — VUILLET, J. in *L'Agronomie coloniale*, Year 1, No. 6, pp. 161 163. Paris, December 1913.

This paper contains the results of the examination of seeds of *Hibiscus* as to their oil content. Owing to the difficulty of husking, the analysis was made on the whole seed. It yielded the following results :

Water	9.64
Mineral matter	6.40
Fat	20.32
Proteids	21.14
Saccharifiable matter	15.66
Crude fibre	12.90
Undetermined	13.94
	100.00

Another sample contained only 17.14 per cent. of fat.

The fat is a drying oil of a light yellow colour. It appears that it could find application in the colour and varnish industries. As the seeds can be fed to poultry without ill effects, it is believed that the cake could be used as food for live stock. The average yield of an acre of " Da " (the Somonos name for this plant) in the Niger valley is about 450 lbs. of seed.

240 – **Utilization of Para Rubber Seed.** — *Bulletin of the Imperial Institute*, Vol. XI, No. 44, pp. 551-559. London, October-December 1913.

Oil. — Para seed oil is a drying oil which dries less quickly than linseed oil, but when the latter is high in price it could be substituted advantageously by Para seed oil. Submitted to several industrial firms, the oil has shown itself suited to various purposes. For soap making it has about the same value as cottonseed oil.

Cake. — Two series of feeding trials have been carried out with Para rubber seed cake and its value as a food for cattle has been clearly established; in general the animals seemed to relish it. The composition of Para rubber seed cake is not very dissimilar from that of linseed cake, the difference being in favour of the former as is shown by the following table.

	Para rubber seed cake	Linseed cake
	Per cent.	Per cent.
Moisture	6.91 to 8.75	11.6
Crude proteins	29.93 » 30.19	29.50
Fat	8.71 » 17.68	7.50
Starch, etc. (by difference)	35.97 » 41.74	35.54
Fibre	4.82 » 5.01	9.10
Ash	4.69 » 5.60	5.20

241 – **Experiments on Tapping Manihot.** – ZIMMERMAN, A. in *Der Pflanzer*, Year 9, No. 12, pp. 585-597. Daressalam, December 1913.

RUBBER, GUM AND RESIN PLANTS.

1. — *Frequence of tappings of Manihot Glaziovii.*

1. *Experiments at Inuhesa.* — The trees of the Inuhesa Rubber Estates were divided into four lots and tapped at different intervals: Lot I twice a week, lot II once, lot III once every two weeks, and lot IV every four weeks. In order to facilitate the study of the yields, the experiments were divided into periods of about 7 weeks (7 periods per year). The average girth of the trees was about 21 inches.

If the accidental variations due to climate are neglected, the table shows the superiority of the yields obtained during the first year by means of two tappings a week (lot I), but at the same time it shows the progressive weakening of lot I in consequence of the too frequent tapping, whilst lot IV shows a gradual increase of its yield.

According to the figures obtained during the beginning of the second year of experiment the writer has calculated the probable yield in grams for the year (Table II).

TABLE I. — *Yield of moist rubber, in grams per tree per period.*

Period	Lot I	Lot II	Lot III	Lot IV
1	105.8	49.8	22.4	10.4
2	76.4	48.0	22.9	12.3
3	50.6	37.7	26.4	11.6
4	55.1	40.2	19.4	12.9
5	66.6	38.6	23.4	12.1
6	80.5	42.7	27.6	14.0
7	32.0	21.3	13.6	14.0
Total of first year	467.0	278.3	155.3	87.3
8	68.9	41.8	30.6	16.5
9	65.1	43.3	29.1	15.5

TABLE II.

	Lot I	Lot II	Lot III	Lot IV
Yield per tree during 1st year	467.0	278.3	155.3	87.3
Yield per tree during 2nd year	296.4	250.9	212.9	138.3
Average yield per tapping per tree during the first year	4.34	5.35	5.97	6.72
Average yield per tapping per tree during the 2nd year	2.85	4.44	7.65	10.64

One important fact in favour of not too frequent tapping is the superiority of the average yield per tapping observed in lot IV during the first year.

2. *Experiments at Amani.* — The trees, four-and-a-half years old and averaging 20 to 22 inches in girth, were divided into three groups tapped as follows: Lot I twice a week, lot II once, lot III once every two weeks. Table III has been prepared like Table II.

TABLE III.

	Lot I	Lot II	Lot III
Yield in grams for the 1st year	460.8	330.2	183.9
Yield in grams for the 2nd year	218.0	317.2	231.4
Average yield per tapping per tree for 1st year	4.5	6.4	7.1
Average yield per tapping per tree for 2nd year	2.1	6.1	8.9

The Amani experiments confirm those of Inuhesa: Trees tapped 104 times a year gave yields showing a considerable progressive diminution. From these experiments it appears that the number of 26 tappings per annum will give the best results for a long period, but only time will show if this expectation is justified.

II. *Influence of the distance between the trees on the yield of latex.*

The following yields of moist rubber per tapping per tree were obtained at various distances of planting.

	gms.
5 × 5 m. (16 ft. 8 in, × 16 ft. 8 in)	5.6
5 × 2.5 m. (16 ft. 8 in. × 8 ft. 4 in.)	3.9
2.5 × 2.5 m. (8 ft. 4 in. × 8 ft. 4 in.)	3.3
2.5 × 1.25 m. (8 ft. 4 in. × 4 ft. 2 in.)	2.1

On equal areas, the close-planted trees yield most up to the present.

242 – **Purchases of Tobacco made by the State Monopoly in Hungary in 1912.** (1) VARIOUS CROPS
(Extract from the publication of the Central Direction of the State Monopoly in Hungary) in *Volkswirtschaftliche Mitteilungen aus Ungarn*, Year VIII, Part XII; pp. 1260-1266. Budapest, December 1913.

In 1912, 10787 Hungarian tobacco growers produced in 940 communes, on an area of 133 256 acres, 150 581 500 lbs. of tobacco of 12 different kinds, of which 149 211 500 lbs. were utilizable. The total cost of purchasing this quantity of tobacco was £ 1 239 407, namely £ 1 212 651 price paid for the tobacco, £14 076 for transport and £ 12 679 expenses for delivery, etc.

The returns of the different kinds of tobacco are as follows :

	lbs
Wrappers for cigars	28 334
Tobacco leaves	36 584 000
Szeged tobacco	21 578 000
Debreczen »	62 323 250
Szutok »	2 968 150
Common garden leaves	3 739 900
Fine » »	163 530
Demi-fine » »	7 938 700
Debrö garden tobacco	174 200
Muskatály of Szentandrás variety	401 300
Muskatály tobacco	94 720
Knaster tobacco	13 217 350

The quantity of foreign tobacco imported in 1912 was 10 821 400 lbs. worth £ 642 173.

243 – **The Relation between an Abundant Rainfall and the Production of Coffee.** – PESTANA, PAULO R. in *Secretaria da Agricultura, Commercio e Obras Publicas do Estado de Sao Paulo, Boletim da Directoria de Industria e Commercio*, Series 4, No. 7, pp. 267-272. São Paulo, 1913.

The writer points out a direct, though not exclusive, relation between the rainfall during the months October to March and the yield of coffee in the

(1) See No. 800, *B.* May 1912; No. 1261, *B.* Nov. 1913. (*Ed.*).

Rainfall			Yeld of Coffee	
Season		mm.	Year	Arrobas
I – *Ribeirão Preto*				
1904–05	October-March	1 573	1906–07	3 261 500
	April-September	270		
1907–08	October-March	905	1909–10	2 497 742
	April-September	196		
1908–09	October-March	896	1910–11	2 316 154
	April-September	293		
1909–10	October-March	1 209	1911–12	2 540 230
	April-September	229		
1910–11	October-March	753	1912–13	2 100 000
	April-September	358		
II – *S. Carlos do Pinhal*				
1904–05	October-March	1 950	1906–07	2 214 550
	April-September	511		
1907–08	October-March	1 595	1909–10	1 601 472
	April-September	321		
1908–09	October-March	2 170	1910–11	* 1 328 160
	April-September	471		
1909–10	October-March	1 459	1911–12	1 403 300
	April-September	523		
1910–11	October-March	1 061	1912–13	1 232 314
	April-September	390		
III – *Botucatú*				
1904–05	October-March	1 124	1906–07	1 026 600
	April-September	402		
1907–08	October-March	1 103	1909–10	765 350
	April-September	201		
1908–09	October-March	863	1910–11	493 140
	April-September	211		
1909–10	October-March	971	1911–12	668 260
	April-September	165		
1910–11	October-March	842	1912–13	510 000
	April-September	477		

* It must be noted that the coffee plants still showed the exhausting effects of the high yield of 1906-07.

season two years later. The same relationship has already been observed in Costa Rica. The figures in the table are those of the three principal coffee-producing centres in the State of São Paulo. The grouping of the months into two periods corresponds to the climatic conditions of the State and to the biological conditions of the coffee plant. October is the beginning of frequent rains, which reach their maximum in December and January and diminish towards the end of March. In April begins the cold dry season during which the coffee is harvested, and this terminates in September. Rains during the hot season favour the flowering the following year and the fruiting of the second year, but during the cold season they are injurious.

244 – **The Selection of Tea.** — BERNARD, CH. und VAN LEERSUM, P. in *Mededeelingen van het Proefstation voor Thee*, No. XXVI, 15 pp. + 4 plates. Buitenzorg, 1913.

Disinfection and selection. — The writers have just perfected a method for disinfecting the seeds of the tea plant and separating those possessing only a low germinative power. The disinfection is accomplished by means of 1 a per thousand solution of corrosive sublimate, and its chief object is to preserve Java from two pests which do not yet exist in the island, but which cause damage in British India : *Exobasidium vexans*, which produces blister blight, and and the green fly (*Chlorita flavescens*).

The seeds after being taken out of the corrosive sublimate bath are plunged into pure water with the object of washing them and separating those that float and which form class (*a*). The seeds that are heavier than water are then placed in a 25 per cent. solution of sugar : some float (*b*) and the others sink (*c*). After the sugar bath also the seeds are washed again in pure water.

The (*a*) seeds have a low germinative power ; they are put into a germinator and those which sprout are added to the (*b*) seeds, which are sown in a nursery ; then the most vigorous plants are selected. As for the (*c*) seeds, the best, they may be sown at once where they are to remain. This method is very rapid, simple and economic, and it has given excellent results.

Grafting. — In order to improve the quality of existing plantations, the writers have devised a method of grafting which gives 70 per cent. of successful grafts, and this with still inexperienced hands. The stock must be between 3 and 5 years of age and the best time for the operation is the beginning of the rainy season. The graft that has yielded the best results is one in which a T-shaped incision is made in the bark of the stock. The scion is a strong shoot bearing three or four buds and somewhat lignified at its base ; its lower extremity is cut to a bevel about 1 ¼ inch in length, and inserted into the T-shaped incision, the sides of which are then drawn together and the whole is carefully bound.

The question of decorticating the tea seeds used for sowing is not completely settled ; it seems, however, that it is preferable to crack the tegument without removing it from the grain.

245 – ***Suaeda fruticosa* for the Fixation of Shingle Beaches.** — OLIVER, F.W. in *The New Phytologist*, Vol. XII, No. 9-10, pp. 357. London, December 1913.

The writer recommends *Suaeda fruticosa* as the most effective stabiliser of all British shingle plants, in virtue of its shrubby habit of growth and high capacity for rejuvenescence.

FRUIT GROWING.

246 – **The Nursery of American Vines in The Tremiti Isles (Adriatic). — Its History and the Results obtained.** — *Communication from the Italian Ministry of Agriculture, Industry and Commerce.*

The discovery in France of the possibility of protecting vineyards from phylloxera by using American stocks led the Italian Ministry of Agriculture to take up the cultivation and distribution of these stocks.

During several years, many kilograms of seed of American vines were distributed among the institutes and vine-growers, and numerous nurseries and important vineyards of stocks were installed in the various districts of Italy. Seed of typical Riparia was first distributed, and later seed of Rupestris and Berlandieri.

Thus up to 1883 the phylloxera-free regions contained four larger nurseries, which supplied vineyards for the production of Riparia seed, namely: one at Rome entrusted to the Royal Practical Agricultural College; one at Parma under the direction of the Royal Agricultural Station; one at Asti, directed by the Royal Oenological Station; and the last at Acireale, under the immediate control of the Agricultural Committee of Acireale.

Nurseries and vineyards of Riparia (type), Rupestris and Berlandieri were then instituted, on a smaller scale, at the special schools of viticulture and oenology and the majority of the schools of practical agriculture. Others again were instituted at the above-mentioned schools and other practical schools with rooted cuttings of American stocks already cultivated in Italy, namely York Madeira, Solonis, Vialla, Taylor, Oporto, Clinton, Concord and Jacquez.

These varieties, however, though at first considered the most suitable for the reconstitution of vineyards, soon lost favour with the growers, owing to the discovery, during continued and extensive experiments carried out in different districts in France, of new stocks resistant to the pest and more suitable from the point of view of cultivation. It thus became necessary to provide for their cultivation and distribution.

It was to supply this need that an attempt was made to establish a nursery of American stocks on the island Montecristo (Tuscan Archipelago) with material bought in France and previously disinfected. Unfortunately, this important attempt came to nothing, as only a year after its establishment, phylloxera was observed in a small portion planted with rooted cuttings, and the Ministry of Agriculture, on the advice of the Consultative Antiphylloxera Commission, decided to destroy without delay all the vines which had been imported to Montecristo, and which were already growing vigorously.

Further, the vineyards first reconstituted with material obtained from seed immediately showed many drawbacks to the system. As it was easy to foresee, the nurseries of stocks (not excluding Riparia) contained a mix-

ture of a large number of varieties, of which many were unhealthy and predisposed to fungus diseases. As to the more vigorous varieties, their suitability for cultivation and their resistance to phylloxera were not yet known. These disadvantages were to some extent obviated by a vigorous selection in all the seed nurseries and by opportune researches on the resistance and suitability for culture of the selected plants.

In order, however, to obtain some information from the above experiments, it was necessary to wait a considerable time, while in some important vine-growing regions in Italy phylloxera was already widely spread and the need of providing for the reconstitution of the lost vineyards was urgently felt. Consequently the Ministry of Agriculture decided not to limit the material available to that supplied from the above mentioned nurseries (in order not to place growers in the infested regions of Italy at a disadvantage to foreigners from the point of view of the reconstitution of their vineyards) and consented to the importation from France, with all the necessary precautions, into the infected regions where they had abandoned the protection of vineyards by destruction, of American stocks which showed more promise of success than those already in Italy. In this way the nurseries of American stocks already mentioned came to be planted in various regions of Italy, and more particularly in Sicily, Sardinia and Elba, where the insect had caused considerable damage.

In 1900, an attempt was again made, this time in the Tremiti Islands, where the starting of a nursery of American vines has been a complete success.

The task of providing for their installation was entrusted to Dr. Leobaldo Danesi, who on two occasions selected the necessary material in France, and took a considerable portion from the Royal Nursery of American vines at Portoferraio.

The Island of San Donnino, about 16 miles from the Apulian Coast, was chosen as being the most suitable of the Tremiti Islands for this purpose; it is the largest of them, having an area of 214 acres. Climatic conditions there approach those of the adjacent coast. Rain is infrequent, and drought continues every year from April to September. The winter is mild and the summer rather hot, but rapid changes are frequent at all seasons, and sharp falls of temperature occur when the north wind blows.

The nursery is at Don Michele, where the soil is a calcareous loam, with subsoil, in places of calcareous tufa and in places of compact limestone, occurring at a depth varying between 20 and 24 inches or even more. Considering its origin, the surface soil is not remarkably rich in calcium carbonate, which reaches 16 per cent. only in some places.

The land was bastard trenched right across to a depth of 2ft. 6 in. During the first year (1900) the nursery covered an area of $5\,^{3}/_{4}$ acres; this was increased in the following years and now reaches 25 acres.

The vines selected were those species and varieties which had given the best results in the trials so far made in Italy, all being stocks except a single hybrid direct-bearer. Preference was given to those suitable for calcareous soils and the southern regions of Italy, which are liable to prolonged drought

In 1904 other stocks were added and a large number of direct-bearers favoured by the French growers, so as to have a supply of this material for the cultivation experiments necessary in the different regions of Italy.

The attached table indicates the number of stocks and direct-bearers grown.

	No. of existing plants	Vines grafted for trial of affinity with the stock	Vines for the production of cuttings
Stocks	40 460	1 067	39 393
Direct-bearers	3 033	—	3 033
Total	43 493	1 067	42 426

Only cuttings were used for planting, and they were taken from very vigorous stocks free from fungus disease. They were examined one by one and all showing any lesion or any sign suggesting presence of disease were rejected. All were then disinfected at Portoferraio by immersion for five minutes in water at 55° C., the temperature scarcely falling 1° and seldom reaching 51° at the time of extraction.

The cuttings thus treated were immediately packed with all care and despatched to the Tremiti Islands. On arriving at their destination they were immersed in a 1 per cent. copper sulphate solution and then planted with a forked stick, the holes being carefully filled in with a thick paste of sand and fine earth. They were planted at a distance of 5ft. each way.

To ensure the striking of the cuttings of Berlandieri and of certain rare varieties, they were grafted onto well-rooted cuttings from a locality absolutely free from phylloxera. To obtain a large number of shoots the first year, 2372 Italian plants in the Giovanella vineyard in the neighbourhood of the nursery, in good condition of growth, were grafted with the principal American stocks. The grafts were made low down so that they might root. The layering was next carried out in such a manner that the same distance was left between each plant as between those in the nursery.

For six years from 1910 the plants were rigorously inspected, with negative results. In spite of all precautions taken in the choice of material the first symptoms of " bramble-leaf " (roncet) appeared during 1903 among some Riparia Rupestris and Rupestris du Lot ; in the following years other plants developed the disease. However, the rapid spread of the disease was checked each year by eradication of the diseased plants and those close to them. Further, in order to effect a rigorous selection, the Ministry of Agriculture sent two specialists in September 1912 to examine with every possible care the entire nursery; they destroyed 223 plants which they considered affected with "bramble-leaf" or suspected. Most of the diseased vines occurred in the Giovanella vineyard where grafts had been made on Italian stocks and then layered. It should be noted that this vineyard is on

rather heavy soil on a steep slope facing north, and is thus subject to considerable variations of temperature.

The first distribution of material was made in 1903 with shoots from three-year-old vines. It was not until 1904-5 that the whole 25 acres was planted with stock-vines. Since then the production has varied in normal years between a million and a million and a half of cuttings of various sizes. This material has been chiefly distributed among societies for protection against phylloxera, numerous agricultural institutions controlled by the Ministery of Agriculture and where possible to private growers.

The societies have established, with material from the Tremiti Is., nurseries of stock-vines covering an area of over 815 acres, capable of an annual production of about 40 million cuttings of various sizes. They have also planted nearly 215 acres of rooted cuttings and established more than 300 vineyards for experiments and demonstrations.

The other institutes have also established new nurseries and transformed seed nurseries by grafting. Perhaps in some places this transformation has been somewhat premature, resulting in the abandoning of certain seedlings produced under conditions very different from those of our vine regions, which might have been more valuable than the ones mentioned; there is now a tendency to take up the study of some of these again.

Besides the establishing of the stock nursery, various other experiments which may be worth describing have been carried out in the Tremiti Islands.

The principal American stocks have been grafted with the better local Vinifera varieties, such as Trebbiano, Sangiovese, Malvasia Galoppa and Tokay, and a very careful account has been made of the growth of the grafts, their production, and the quality of their produce, etc., so as to obtain practical knowledge of their binding with the stocks in question.

Every year hybrids have been made among the different American varieties and between them and the above-mentioned Italian ones. Selection of the seedlings was made in the seed-bed and those which showed by their morphological characters that they were not hybrids, were rejected. The selected seedlings were then sent to the experimental vineyards of Cassano and S. Michele in the province of Bari, where their resistance to phylloxera is being tried. Some plants already give hopeful results.

The fruit and musts obtained from the direct bearers have been analysed each year, and also the products from the grafted vines, to determine the influence of the stocks on the quantity and quality of the product. Results of some importance have been obtained, and will be published shortly.

Numerous experiments have been made on the disinfection of vines and their resistance to hot water. Dr. Danesi has given an account of these researches and other experiments made elsewhere in various papers, some of which were published in the *Atti dell'Accademia dei Lincei*.

Thus we may conclude that the nurseries of American stocks in the Tremiti Islands have supplied a veritable need of Italian viticulture and have completely attained the object for which they were established.

247 – **The Composition of Irrigated and Non-Irrigated Fruits** (1). JONES, J. S. and COLVER, C. W. in *Idaho Agricultural Experiment Station, Bulletin* No. 75, pp. 1-53. Moscow, Idaho, August 1912.

It is a generally widespread belief that irrigated fruits are more liable to decay and possess less flavour than non-irrigated fruits. Since this inferiority is attributed to abnormally high percentages of water and correspondingly low percentages of solid matter, analyses were made of the content of dry matter, sugar, acid and crude protein in various fruits grown under these two systems, with a view to testing the truth of these suppositions. It was not presumed, however, that chemical analyses alone could settle questions relating to quality in fruits.

The material used in these analyses was not obtained from specially controlled plots ; all irrigated samples were grown in districts where climate and soil render irrigation imperative, all non-irrigated samples in idstricts where the annual rainfall varies from 25 to 35 inches and where the soil and topography of the country render irrigation methods impracticable. The comparisons are therefore made between *normal* irrigated and normal non-irrigated fruits.

In the case of drupaceous fruits, analysis shows distinct differences in favour of non-irrigated fruits, especially when the results are calculated on the dry matter ; but they are not considered sufficiently large to seriously affect the taste, except in the case of Italian and Petite prunes.

In the case of apples, the non-irrigated almost invariably contain greater percentages of acid and sugar, but the differences are small and practically disappear when calculated on the total dry matter. Irrigated apples contain a smaller percentage of solids insoluble in water, but in intensity and uniformity of colour, and in percentage of waste, they have somewhat the advantage over the non-irrigated.

Of the small fruits, strawberries alone show any marked difference in composition due to irrigation. When irrigated they are decidedly inferior in dry matter, sugar, acid and crude protein, and they lose their freshness and keeping qualities much earlier. In the case of blackberries and raspberries, irrigation results in an increased percentage of sugar and a decreased percentage of acid when calculated on the total dry matter, and is therefore a distinct advantage in growing these fruits for marketing in the desiccated condition.

In general, it may be said that no marked differences in food and market value of fruits can be attributed to the effects of irrigation.

248 – **The Pollination of the Coconut.** — PETCH, T. in *The Tropical Agriculturist*, Vol. XLI, No. 6, pp. 449-455 + 2 figs. Peradeniya, Ceylon, December 1913.

The coconut tree is monoecious and the flower diclinous ; a period of from 2 to 5 days elapses between the shedding of the last male flower and the opening of the first female flower. Pollination can therefore only be effected by pollen from other inflorescences of the same tree, when the flowering periods overlap, or from the male flowers of neighbouring trees.

(1) See No. 1348, *B.* Dec. 1912. (*Ed.*)

Thus the duration and frequency of the flowering periods is of the utmost importance in determining the degree of fertility of the tree.

From an examination of the structure of the female flower, the writer concludes that pollination is generally effected by bees and hornets and also to a large extent by the wind. Though ants are abundant on the inflorescences, their access to the stigma is prevented by the exudation of a ring of sticky juice from a large number of pores situated on the exposed area below the stigma.

Observations made during 1912-13 on the opening and shedding of flowers showed that, to ensure overlapping, the interval between successive flowering periods should not exceed 30 days, thus necessitating the production of 12 or more inflorescences per annum. The intervals varied between 24 and 58 days, being longest at the beginning of the year and shortest about May and June.

Observations on the shedding of immature nuts gave inconsistent results. Overlapping of the flowering periods was not followed by an increase in the number of nuts retained. Further experiments are necessary to determine the relation of this phenomenon to fertilisation.

249 – **The Flowering of Pears.** — CHITTENDEN, F. G. in *The Journal of the Royal Horticultural Society*, Vol. XXXIX, Part 2, pp. 366-372. London, December 1913.

The writer gives a list of varieties of pear trees under observation at Wisley, arranged in relative order of flowering, and showing what varieties may be expected to be in flower at about the same time each year.

250 – **The Cultivation of Teak in Java.** — SCHAEFFER, G. in *Journal d'Agriculture tropicale*, Year 13, No. 150, pp. 353-356. Paris, December 1913. FORESTRY.

Java possesses at present upwards of 1 480 000 acres of teak forests, and this splendid asset increases every year, as the area reafforested is two and a half times larger than the area felled during the same time; on the other hand teak is nowhere cultivated except in Java. In the island the conditions required for the cultivation to be profitable are a fair soil of at least medium fertility, a minimum of 60 cm. (40 in.) of yearly rainfall and an altitude inferior to 100 m. (330 feet).

Regeneration. — Teak sends up numerous shoots from the stool, but the trees thus obtained being much inferior to seedlings, this mode of regeneration is not utilized. The seeds are sown in holes in rows at 3ft. by 10 ft. Other crops, such as rice or earthnuts, are grown between the rows during the first year.

Maintenance.— The greatest attention of the forester is devoted to preventing alang-grass (*Imperata arundinacea*) from invading the plantation; hoeing being too expensive, *Leucena glauca*, a leguminous plant, is sown between the rows as a cover plant; it chokes the alang and keeps the soil clean; besides which it prevents the leaching out of the soil and enriches it in humus and nitrogen and disappears when the cover of the forest is sufficient.

Felling. — The new artificial forests are still too young to be felled; but it is estimated that the trees will attain a diameter of 24 inches at the age of 80 or 100 years.

LIVE STOCK AND BREEDING.

HYGIENE

251 – **New Investigations into the Life History of the Two Warble Flies of Cattle** (1). — GLASER, HANS, in *Mitteilungen des Ausschusses zur Bekämpfung de Dasselplage*, Part 5, pp. 5-38. Berlin, 1913.

The writer reports upon the continuation of his investigations into the life history of the two warble flies of cattle, undertaken for the Committee for the Control of Warble Flies. Altogether 314 warble flies were bred from 375 mature larvae that had spontaneously left their warbles; of these, 208 were the large *Hypoderma bovis* and 106 the smaller *H. lineata*. In this connection it was found that the issuing of the larvae took place early in the morning and in by far the greatest number of cases while the host animals were standing or walking and only exceptionally while they were lying down ; it begins mostly half or three-quarters of an hour after the animal stands up, and is interrupted if the animal lies down again. The writer explains this fact by the difference in the tension of the skin of the cattle.

On the same animal larvae of the large and of the small warble fly may be found. On issuing from the hide they are easily distinguished. The larvae of *H. lineata* are smaller and more slender than those of *H. bovis* and when mature they are gray brown, while those of the larger fly are greenish brown. The colour is a sure test, even when small and slender larvae of the larger fly are found. In general the larvae of the smaller fly are somewhat earlier than the others.

The change into pupa takes place on warm and dry days mostly within 24 hours ; in rainy and cold weather the process lasts 2 to 4 days. The larvae of *H. lineata* always require less time for the change than those of *H. bovis*. The pupal stage of the small fly averages 30 days, that is 14 days less than that of the larger fly. In general the males have a shorter pupal stage than the females ; thus the latter, on issuing from the pupa, always find sufficient males with which to mate.

The emergence of the flies takes place in the early morning and by preference on fine sunny days ; this explains their appearing in large numbers when the wheater is fine. The swarming of *Hypoderma lineata* is for the most part in June, that of *H. bovis* in July.

The deposition of eggs takes place most frequently immediately after mating. Both the small and the large fly generally lay their eggs on the legs, and by preference on the hind legs a little below the hock. Besides this, the writer saw the flies frequently depositing their eggs on the belly of a calf used for experiment. Occasionally a fly would settle on the flanks or breast. No fecundated female ever deposited eggs on the back of the calf. The animal always became very excited on the approach of a female fly, whence the writer concludes that during June and July, and perhaps August, the gadding of cattle is due to warble flies. The fly

(1) See No. 144, *B.* Feb. 1913. (*Ed.*).

causes its eggs to adhere to the hair of the host and the writer observed that the large warble fly sticks only one egg per hair, while the small fly sticks several of them on one hair, as many as 15 having been counted.

The egg of *H. bovis* is larger and more slender and more pointed at the free end than that of *H. lineata*. Further, the stalk which joins the egg of the large fly to the extension that embraces the hair is thinner than in the eggs of the smaller fly. The habit of the small warble fly of laying several eggs on one hair explains the fact that during oviposition it fastens itself more firmly to the hair than the other fly ; it holds its ovipositor nearly parallel to the hide of the animal, while *H. bovis* sinks it almost vertically into the hair. The number of eggs that one fly can lay under favourable circumstances was determined by the writer for one *H. lineata* : it amounted to 550.

In the eggs very spiny maggots or bots develop after a few days ; they issue from the eggs on to the hide of the animal : the writer assumes that the cattle take up the larvae rather than the eggs.

The writer has also conducted experiments in order to ascertain if the larvae of the two warble flies are able to penetrate into the skin of man and of animals. The result has always been negative as regards cattle, but in man, in one case (on the writer himself), a larva penetrated the skin of the thigh.

Last year for the first time infection experiments could be carried out on six cattle with fecundated eggs and larvae. The results, however, will not be determined till the spring. The writer hopes soon to be able to report upon the most suitable methods of controlling this pest.

252 – **The Natural Infection of Calves with Tubercle Bacilli.** — CHAUSSÉ in *Comptes-Rendus Hebdomadaires des Séances de l'Académie des Sciences*, Vol. 157, No. 16, pp. 642-644. Paris, October 20, 1913.

The writer submitted to careful examination 56 calves destined for the slaughterhouse and suffering from typical tuberculosis, with the object of ascertaining the principal way by which the tubercle bacillus had entered their bodies. Of the 56 animals, 44 had typical tubercles in the lungs, while all the other organs, including those of digestion, were intact. The infection then must have followed the respiratory canal. Material from the intestinal glands of 11 animals was inoculated into guinea-pigs and produced tuberculosis only in one case. But in this case also it was not certain that the corresponding calf, besides lung tuberculosis, had not intestinal tuberculosis also.

Of the remaining 12 calves, 8 showed decided tuberculosis of the liver and its glands. In these cases, the infection must have taken place before birth, which seems all the more probable as the stage of the disease was much more advanced than in the pulmonary tuberculous calves. The four last calves had severe intestinal tuberculosis and had tubercles in the walls of the intestine and in the mesenterial glands. The tubercle bacillus in these calves had undoubtedly been introduced with their food. In all the calves the glands of the infected organs were much degenerated. The

animals infected before birth showed a more advanced degeneration than those infected by the air or food.

The writer concludes from these investigations that the animal organism has aways the tendency to oppose a local reaction as soon as possible to any local infection with tubercle bacilli. Consequently the development of the disease proceeds somewhat more rapidly in the calf than in mature cattle. Calves take the tubercule bacillus in the great majority of cases from the air. Nevertheless, infection before birth is not unimportant. Infection by means of the food is much rarer than through the blood. In France the writer found in 6000 slaughtered calves only one that had been infected by its food. The reason of this may partly lie in the fact that the herds of cows are relatively only very slightly affected by tuberculosis. In pigs, this kind of infection is naturally much more frequent, owing to their very varied food. In 169 pigs that were slaughtered the writer found one animal that had taken the bacillus with its food.

It can therefore be assumed that cows' milk is only in the rarest cases the cause of human tuberculosis.

253 – **Piroplasmosis of Cattle in Hungary.** — FABRICI, JÁNOS in *Allatorvosi Lapok*, Year XXXVII, No. 4, pp. 37-38. Budapest, January 24, 1914.

The writer gives a description of *Piroplasma bovis*, which makes its appearance in some regions of Hungary, especially in the mountainous parts of the county of Mármaros, where it is so virulent as to cause even more havoc than authrax, with which it is easily confused. In the mountainous districts the disease appears at the beginning of the warm days in spring, generally in the month of May, when the cattle grazing on bushy pastures are attacked by hundreds of ticks, vehicles of the disease.

Piroplasmosis may become chronic, and even contagious. According to M. Hustyra, director of the Royal Veterinary College of Budapest, it is curable. Considering its ravages from an economic point of view, the writer recommends a minute investigation being made.

254 – **Scab and its Cause, with Special Consideration of Chamois Scab.** — FIEBIGER, J. in *Zeitschrift für Infektions-krankheiten, parasitäre Krankheiten und Hygiene der Haustiere*, Vol. III, Part 6, pp. 341-365. Berlin, November 28, 1913.

The writer describes, with the aid of illustrations, chamois scab, the morphology and physiology of the mite that causes it, and discusses the results of his recent experiments on the transmission of chamois scab to three goats and a sheep. The most important results are the following :

1. Goats can be artificially infected with chamois scab and from infected goats the disease can spread spontaneously to other goats. From this it may be inferred that the natural transmission of scab from chamois to goats is possible.

2. Sheep also, though with much greater difficulty than goats, can be artificially infected with chamois scab. A spontaneous transmission of chamois scab to sheep seems, however, unlikely.

3. Transmitted scab in goats has the tendency to heal by itself. The

growth of hair proceeds with extraordinary rapidity. The healing process is ushered in by a falling off of the scabs.

4. The disease begins by the skin becoming horny, which symptom predominates throughout; atrophy, inflammation and hyperplasia set in.

5. The scab mites of many animals do not excavate passages in the epidermis in the direction followed by the sarcoptes mite of man, but they bore vertically or in an inclined direction though all the epithelial layers and finally reach the hypodermis.

255 – **The Udder as an Emunctory: Elimination of Artificial Colouring Matter by the Udder.** — FORCHER, CH. in *Revue générale du Lait*, Vol. 9, No. 18, pp. 409-419. Lierre, November 30, 1913. ANATOMY AND PHYSIOLOGY.

In the first experiment the writer introduced by means of an esophageal tube into the stomach of a goat 0.5 gram of uranin; neither the milk nor the urine of the goat nor the urine of her kid showed later any trace of uranin. Then 1 gram of uranin was injected into a vein of the neck of the same goat, but no proof of the presence of uranin was detected either in the urine of the goat or kid or in the milk or in the digestion product of the casein. The same result was obtained with 3 grams of uranin introduced into the stomach of the goat.

In a second experiment the writer introduced into the stomach of a goat 2 grams of rhodamin. After an hour she yielded a rose-coloured milk; after three hours the rose colour was much weaker and the following day it had disappeared. Submitted to dialysis, the milk allowed the rhodamin to pass through the membrane. On coagulating the milk with acetic acid a rose-coloured casein was obtained, the colour of which disappeared on the further addition of acid. The urine of the two kids was slightly coloured, that of the mother highly coloured. In comparison with the quantity given, the amount that passed into the milk was very small. The rhodamin contained in the milk was completely eliminated in the urine of the kids.

In a third experiment a goat was given 1 gram of methylene blue (Hydrochloride). Her urine and excrements were coloured a deep blue and contained leuco-derivates; but her milk and the urine of the kid showed no traces of blue colouration. Another goat had 3 grams of methylene blue injected into a vein with the result of a slight coloration of the milk and a very slight colour in the urine of the kid. The day after the injection the milk had recovered its normal colour. The quantity of methylene blue that had passed into the milk was at most one three-hundredth part of the quantity administered.

In a fourth experiment 3 grams of crystallized ponceau were introduced into the stomach of a goat. Neither the goat's milk nor the kid's urine showed traces of ponceau.

Lastly in a fifth experiment the writer gave a bitch and three goats dimethylamino-azobenzol. The bitch had 1 gram by way of the stomach, and one hour later the milk, on the addition of hydrochloric acid, was intensely rose-coloured. The puppy also excreted the colouring matter with its urine. Goat No. 1 had 1 gram of dimethylamino-azobenzol introduced

into her stomach, but did not eliminate the colouring matter either in the milk or in the urine. Only the next day, when she was given another gram of the same substance, could its presence in the milk be detected, and a few hours later the milk had recovered its usual colour. Goat No. 2 was also given 1 gram of the colouring matter without its appearing in the milk or the urine. Goat No. 3 was given 5 grams of dimethylamino-azobenzol and only after some hours did her milk become deep blue. On dialysing it, it was found that by far the largest portion of the colouring matter had dissolved in the fat of the milk.

The writer draws from these observations the conclusion that the colouring matters are not eliminated from the udder by only one of the components of milk. In order to leave the udder, some colouring matters dissolve in the whey, others attach themselves to the casein, and others again dissolve, immediately on entering the udder, in the fat globules of the milk. This latter process, according to the writer, is the one to which all colouring matters having a basic reaction are subject, fat being a good solvent for them.

It can therefore be assumed that the intense coloration of butter observed in summer from cows grazing where yellow flowers are abundant is due to the plant components possessing a basic reaction.

It has further resulted from the experiments that the milk glands do not easily allow the passage of colouring matter and seem to exert a severe selection on all molecules brought by the blood, some being accepted and others as strictly as possible rejected. The writer believes, therefore, that the composition of the food and that of the milk are not so closely connected with each other as is commonly believed.

FEEDS AND FEEDING.

256 – The Effect of Sugar on the Digestion of Nitrogen. — GOUIN, ANDRÉ and ANDOUARD, P. in *Comptes-Rendus Hebdomadaires des Séances de la Societé de Biologie*, Vol. 75, No. 36, pp. 550-552. Paris, December 19, 1913.

The writers, in continuation of a previous experiment, carried out a feeding experiment on a growing pig in order to test the effect of sugar on the utilization of nitrogen. The animal was fed daily, during the first period, 500 grams of earthnut cake, 70 grams of degelatinized bone meal and manioc roots *ad lib.* In the successive period the rations were the same, except that Jerusalem artichokes were given *ad lib.* instead of manioc roots. Each period lasted 42 days and during both the writers carried out investigations on the foodstuffs given and utilized. The daily increase of weight was, during the starch (manioc) period, 667 grams, and during the sugar (Jerusalem artichoke) period 595 grams. The manioc starch was always completely utilized, while the sugar of the artichokes was often only incompletely taken up. During the latter period the animal ejected in its excrements considerable quantities of undigested food. At the same time a typical effect of the sugar on the digestion of nitrogen was noticeable, namely that in consequence of a less intense bacterial activity the quantity of nitrogen transformed into gas in the stomach was diminished. While this loss, during the starch period, amounted to 9.38 per cent. of the nitrogen in the food, during the sugar period the loss

was only 0.07 per cent. In previous experiments with a heifer calf the corresponding losses were, in the starch period 20.10 per cent., and in the sugar period 15.86 per cent., while with a steer the losses were respectively 26.77 and 14.08 per cent. It appeared further that when feeding sugar a more abundant excretion of nitrogen in the droppings took place. During the starch period the pig excreted an average of 25.93 per cent. of the nitrogen of the food and during the sugar period 48.73 per cent. In a previous experiment with a heifer calf the corresponding values were respectively 31.86 against 39.43, and with a steer 35.33 against 56.34 per cent.

This experiment thus confirms the observations made previously by the writer on a growing steer, that sugar diminishes the utilization of nitrogen and the loss of nitrogen by fermentation in the alimentary canal.

257 – **The Organic Phosphoric Acid of Cottonseed Meal.** — ANDERSON, R. J. — *New York Agricultural Experiment Station, Technical Bulletin*, No. 25, pp. 1-12. Geneva, N. Y., December 1912.

An acid has been isolated from cottonseed meal which decomposes into phosphoric acid and inosite when heated with sulphuric acid and is in every way very similar to phytic acid. When fed in does of 0.5 and 1 gm. to rabbits, symptoms of distress were observed which passed off in a few hours.

258 – **Cattle-Feeding Experiments.** — BRUCE, W. — *Edinburgh and East of Scotland College of Agriculture, Report* XXXI, 1913. CATTLE

During the season 1912-13 the experiments of 1911-12 (see Report XXVII) were continued and a comparison was made between the feeding values of linseed cake, of wheat bran, and of a complex mixture consisting of:

Undecorticated cotton cake	2 parts
Decorticated » »	1 »
Linseed cake	1 »
Bran	3 »
Maize meal.	1 »

and compounded so as to contain approximately the same amount of food material as would be present in an equal weight of linseed cake.

Three lots of cattle consisting of 16 individuals each were fed with the above materials. The trials were carried on for 19 weeks and the average daily rations during that time were:

Lot I	3.95 lbs. linseed cake, 3.78 und. cotton cake	10.2 lbs. swedes
Lot II	5 lbs. bran » » » »	7.78 » oat straw
Lot III	7.73 lbs. complex mixture	

The three lots made practically the same increase, the average daily gain being just over 2 lbs. per head, and no differences were observed in the finished cattle of the different lots which could be attributed to the feeding. With linseed cake at £ 8. 16. 3 per ton and wheat bran at £ 5. 8. 9 per ton the concentrated food of Lot 1 cost £ 5. 16. 3 more than that of Lot II, after the value of the manurial residues have been deducted.

259 – **A Study of the Udder Flora of Cows.** — HARDING, H. A. and WILSON, J. K. — *New York Agricultural Experiment Station, Technical Bulletin* No. 27, pp. 1-40. Geneva, N. Y., March 1913.

1230 samples of milk derived from 78 cows were examined bacteriologically. Separate samples were drawn from each quarter of the udder and showed that the germ content can vary considerably in the different quarters of the same udder, the back quarters usually having a far higher germ content than the front ones. Neither the age of the cow nor the period of lactation appeared to exert any marked influence on the germ content of the milk. The number of organisms per cc. varied from 0 to 16 600, with an average of 428. They were classified into 71 groups and were characterised by lack of motility, of spore formation, and of gas formation, consisting largely of micrococci and being practically all Gram positive.

PIGS

260 – **Carcase Tests conducted on Lincoln and Mangalicza Pigs in Hungary.** — WELLMANN, O. in *Köztelek*, Year 23, No. 97, pp. 3272-3275. Budapest, December 13, 1913.

It is well known that the most esteemed breed of pigs in Hungary is the curly-coated Mangalicza pig (1), which owes its popularity to its high yield in fat and its suitableness to the conditions of the country. With the growing intensity of agriculture in Hungary, it becomes very desirable to improve this breed from the point of view of prolificacy and early maturity.

The English Lincoln Curly-coated breed resembles the Mangalicza in many points, but is more prolific and earlier maturing ; consequently it seems the most suitable for the improvement of the latter breed.

With this object in view, crosses between Lincolns and Mangalicza have been practised since 1910. In order to ascertain how far the Lincoln pigs answer to the requirements of the Hungarian breed, the National Agricultural Association of Hungary (Orzságos Magyar Gazdasági Egyesület) entrusted a committee with the carrying out of carcase tests in the municipal slaughterhouse of Budapest on fattened Lincoln and Mangalicza pigs and on crosses between the two breeds. The description of the pigs experimented upon and the carcase results are shown in Table I.

These data show that among pigs fattened for five months on barley and maize groats the dead-weight of Lincoln × Mangalicza pigs at 14 months was the same as that of the pure-bred Mangaliczas at 26 months. The dead-weight of all the animals amounted to 82 to 88 per cent. of the live-weight.

(1) See No. 559, *B.* May 1913. (*Ed.*).

TABLE I.

Pigs slaughtered	Age	Live weight		Blood		Bristles		Offal		Internal fat		Dead weight	
	Months	lbs	%	lbs	%	lbs	%	lbs	%	lbs	%	lbs	%
Lincoln × Mangaliczà .	28	730	100	14	1.9	10	1.4	72	9.8	28	3.9	629	86.1
Mangaliczà	50	535	100	10	1.8	10	1.9	44	8.2	18	3.5	471	88.4
Lincoln.	42	847	100	—	—	—	—	—	—	—	—	713	84.2
Mangaliczà	26	420	100	—	—	—	—	—	—	—	—	365	87.0
»	»	469	100	—	—	—	—	—	—	—	—	385	82.2
Lincoln × Mangaliczà .	14	453	100	—	—	—	—	—	—	—	—	385	85.0
» » .	»	495	100	—	—	—	—	—	—	—	—	431	87.1

201 – **Bacteriology of the Hen's Egg with Special Reference to its Freedom from Microbic Invasion.** — RETTGER, LEO F. in *Centralblatt für Bakteriologie, Parasitenkunde und Infektionskrankheiten*, Vol. 39, No. 23-25, pp. 611-624. Jena, January 6, 1914. POULTRY

In the course of the extended investigations of bacillary white diarrhœa of chicks, which has been carried on at the Storrs Agricultural Experiment Station for the past three years, bacteriological examinations have been made of more than ten thousand eggs. Many of the eggs were fresh when examined, while others had been incubated from one to three weeks. Most of the eggs came from the College and Station stock ; others were received from different parts of the country.

For the investigations only clean and normal-looking eggs were used. In testing the eggs agar cultures were made from the yolk and the white, both the direct and the indirect methods being followed. The writer also conducted a series of fermentation experiments in order to determine the presence of organisms of the Bacillus coli type.

Table I shows the number of eggs examined and the numbers of bacteria found in them.

Bacterium pullorum, the specific organism of white diarrhœa, is no indication of the bacterioloicgal content of the eggs, as all the eggs infected with it come from ovaries in a pathological condition. Excluding this bacterium it is interesting to note that eggs which have been incubated from one to three weeks contain very few bacteria. But the yolks of fresh eggs also show a low bacterial content. Among the incubated eggs, those that had been incubated one week contained considerably more bacteria than those which had been incubated two weeks. The reason of this is not clear, as the temperature of incubation was the same in the two cases. It is, of course, true that the first-test eggs are to a large extent infertile; they also include some which, although they have been fertilized, have failed

State of eggs when tested.		Number of eggs tested	Number of infected eggs	Number containing *B. pullorum*	Per cent. infected eggs, not including *B. pullorum*
Fresh eggs	Entire yolks	3 510	500	169	9.5
Incubated one week	Entire yolks	1 746	68	20	2.75
Incubated two weeks	Entire yolks	2 167	56	28	1.3
Incubated three weeks	Entire yolks	1 984	179	108	3.6
Fresh eggs: whites, 5 cc. quantities		582	7	0	1.2
» » yolks, 10 cc. quantities		647	36	11	3.86

to undergo embryonic development. According to these facts, fertile eggs appear less liable to bacterial invasion than infertile ones, which is contrary to general opinion. It is probable that some of the fertile eggs which failed to develop contained bacteria which prevented or arrested early development.

That the relative number of eggs which harbour bacteria other than *B. pullorum* is greater for those which have been incubated three weeks than for the seven and fourteen day eggs is to be expected.

The percentage of positive results obtained with the whites is undoubtedly higher than the actual facts warrant. It must be said, however, that these investigations were made in the height of summer, that is at a time when considerable difficulty was experienced in obtaining aseptic conditions. It is therefore probably safe to say that the whites of fresh normal eggs are as a rule sterile.

In the fermentation tests, which were made to determine the presence in the whites of the gas-forming bacteria, 105 eggs were examined and the results were all negative.

The microorganisms found in the yolks of fresh and incubated eggs from healthy ovaries, arranged according to the number of times found, are grouped in the following summary:

Fresh eggs.	Incubated eggs.
Staphylococcus usually *aureus* and *albus*.	Staphylococcus usually *aureus* and *albus*.
Subtilis group » *B. mesentericus* and *B. ramosus*.	B. coli and closely related organisms.
B. coli and closely related organisms,	Subtilis group, usually *B. mesentericus*.
Proteus group.	Proteus group.
Streptococcus.	*B. pyocyaneus*.
Micrococcus (*tetragenus*, etc.).	Streptococcus.
Streptothrix.	*Streptothrix*.
Diphtheroid bacillus.	Mould.
Putrefactive anaerobes.	*B. fluorescens*.
B. fluorescens.	Diphtheroid.
Mould.	*B. mucosus*.
B. mucosus.	

The writer compares these results with the data given by other investigators, especially Lamson, Poppe, Stiles, Bates, Zörkendörfer and Kossowicz, and then gives the following summary and conclusions:

1. The contents of normal fresh eggs are, as a rule, sterile. It is quite probable that an egg yolk may become invaded before it is expelled from the ovary ; but this is apparently an uncommon occurrence except when the ovary is infected with the organism of bacillary white diarrhœa.

2. Little if any infection takes place in the oviduct while the white and the shell are being deposited, on account of the protective action of the mucous lining and also the bactericidal action of the egg white itself.

3. Even eggs that have been incubated artificially for three weeks remain relatively free from bacterial decomposition, providing they were fresh and clean when placed in the incubator.

4. Under normal conditions the shell is bacterium-proof. Moisture lessens its impervious character, however, and when combined with dirt, makes it possible for micro-organisms to enter. Increased temperature then hastens the decomposition.

5. Eggs should be gathered from the nests soon after they are laid; the nests must be kept in a sanitary condition to prevent soiling of the eggs.

6. When they are to be preserved for any length of time only clean eggs should be selected ; unless they are placed in preserving fluids, eggs must be kept dry.

7. There is no evidence to indicate that fertilized eggs spoil more readily than the unfertilized, as they do not contain more bacteria than the latter.

FARM ENGINEERING.

AGRICULTURAL MACHINERY AND IMPLEMENTS

262 – **Ransome's Steam Traction Engines.** — MANRIN, in *Bulletin de la Société pour l'Industrie Nationale*, Year 112, Vol. 120, No. 3, pp. 483-485. Paris, November 1913.

The writer describes these traction engines, which have two speeds, 1½ and 3 miles per hour. They are built in five sizes.

The first four traction engines have one cylinder, the last is a compound. Their normal performance is respectively 5, 6, 7, 8 and 10 H P. Besides their usual work as traction engines for agricultural tillage implements, they may be used as common portable engines.

263 – **The Electromotor and the Small Farm.** — STRAUSS, W. in *Dinglers polytechnisches Journal*, Year 95, Vol. 329, Parts 1 and 2, pp. 4-7 and 20-23. Berlin, January 3 and 10, 1914.

While about fifteen years ago it was currently believed that electric energy was especially suitable for large farms, now, on all sides, it is seen that it is especially the medium and the small farmer who can use electric power very advantageously. In this paper the writer points out the great benefits that small farms derive from the use of electric power, and comes to the conclusion that it renders possible an increase of the gross returns,

a diminution, though small, of working expenses, and, what is of great importance to the farmer, the substitution of mechanical power in the place of labourers and teams. A further beneficial effect of the use of electricity is a further development of the spirit of cooperation.

264 – **Agricultural Motors for the West Indies.** — *The Implement and Machinery Review*, Vol. 39, No. 466, p. 1363. London, February 1, 1914.

According to a report of the Canadian Trade Commissioner in Barbados, the Imperial Department of Agriculture and the local agricultural associations in the British West Indies afford assistance to firms importing machinery and implements. In Ste. Croix in consequence of experiments previously made by the Danish authorities, agricultural motors have been imported and work successfully. The Canadian Trade Commissioner further reports that in St. Kitts, St. Lucia, Montserrat and Antigua the soil is deep and loamy and consequently suitable to mechanical tilling. In Barbados, on the contrary, with the exception of small areas, the soil is not suitable.

265 – **The Work of the Windlasses, of the Cables and of the Pulleys in Mechanical Ploughing Outfits.** — RINGELMANN, M. in *Bulletin de la Société d'Encouragement pour l'Industrie Nationale*, Year 112, Vol. 120, No. 3, pp. 465-482. Paris, November 1913.

In the few experiments hitherto made with steam ploughing windlass and cable outfits, the observations were limited to a determination of the work of the cylinder by means of an indicator and to a comparison of this with the work done by the ploughing implement. With internal combustion motors the consumption of fuel was compared with the performance of the ploughing implement. Such determinations, however, from the technical point of view are insuficient, and M. Ringelmann in connection with the trials at Plessis, in which Howard's system of cable tackle round the field was used, calculates in this paper on the one hand the amount of energy required by the windlass, under the various conditions of position and length of the cable as well as the position and number of the guide and corner pulleys, and on the other hand the energy transmitted to the tilling implement situated at the other end of the cable.

The writer gives a summary at the end of his paper, with data on the percentage distribution of the total energy transmitted from the motor to the windlass.

Energy required	for the windlass	3.4	24.9
	» » corner pulleys	15.5	
	» » cable	4.2	
	» » various losses	1.8	

Energy given up at the extremity of the cable	75.1	Energy required by plough	61.0
		Energy for paying out the cable	14.1
Total energy supplied by the motor			100.0

The following is the distribution of the energy required by the cable:

Energy required	for the cable	4.2	30.1
	for the corner pulleys .	2.8	19.6
	for the windlass drum .	7.1	50.3
Energy transmitted by the plough . . .		14.1	100.0

These data facilitate in a simple manner the determination of the consumption of energy for any system of mechanical tillage.

266 – **Trial of Motor Ploughs.** — *Mitteilungen der Deutschen Landwirtschafts-Gesellschaft*, Year 28, Part 42, p. 580. Berlin, October 18, 1913. — *Deutsche Landwirtschaftliche Presse*, Year 41, No. 2, pp. 16-17. Berlin, January 7, 1914.

From the official report of the trial of motor ploughs which took place at Klein Wanzleben from August 21 to 23, 1913, the following verdicts are taken:

1. *Motor plough of Friederich Kuers (Tegel).* — The two-engine system of steam ploughing has the advantage of great steadiness of work, but the disadvantage that the tackle is cumbersome to move about and that heavy outlay is required on the plant in comparison to the work done. This system further lends itself only to a limited extend to other work besides ploughing. The traction engines are solidy built and reliable and in consequence of the low number of revolutions are probable durable. During the main trial the performance was limited in quantity; during the trial of resistance it was higher; the quality of the work was good.

2. *I. H. C. 30 to 60 H. P. motor with eight-furrow plough of the German International Harvester Company Ltd., (Berlin).* — The tractor system is easier to move about and is suitable for mowing and many other agricultural operations besides ploughing. On slippery or very loose soil there is the danger of coming to a standstill through the wheels skidding. The number of revolutions of the motor is moderate and its probable durability is good. Its performance was very good, both as regards quantity as well as quality.

3. *Caterpillar motor tractor with tilling and transport implements belonging to it, presented by the general agent of the Holt Caterpillar Company (Budapest).* The Caterpillar system presents the advantage of great traction power and consequently it is relatively very reliable; on the other hand its installation is expensive and it is somewhat cumbersome to move about. The traction engine is complicated and, it is anticipated, will be very liable to wear out. Its performance was very good, as to both quality and quantity.

4. *Universal 45 to 50 H. P. motor plough, of the Universal Motorpflug-Gesellschaft m. b. H. (Munich)* — The machine presented the advantages and disadvantages of the tractor system. Its construction led to numerous interruptions of work. Its performance was very good as to quality, but low as to quantity and the consumption of fuel was high.

5. *Pöhls' Patent motor plough, of Gustav Pöhl Maschinen and Motor pflugfabrik, g. m. b. H. (Gössnitz, Sachsen-Altenburg.)* — Pöhl endeavoured

to apply the tractor system to small farms. The machines did not show satisfactory reliability.

6. *Stock motor plough, of the Stock Motorpflug-Gesellschaft m.b. H. (Berlin).* — Stock represents the first machine built on the motor-car plough system, which offers the advantage of combining low total weight and correspondingly low cost of installation. Its reliability on soft soils is greater than with the tractors, with the exception of the Caterpillar. The construction is good, but the number of revolutions of the motor is high and its probable duration is limited. Its performance was sufficient as regards quality and good as to quantity.

7. *Power plough on Wendeler Dohrns' system of the Deutschen Kraftpflug-Gesellschaft m. b. H. (Berlin).* The motor plough is a handy and solid development of the motor-car plough. Its performance was good in quality and quantity.

8. *"Acra" motor plough of the "Kyffhäuserhütte" Aktien-Maschinen fabrik.* — This machine is intended as a development of the motor-car plough system for the heaviest work. It will, however, attain this object only after certain improvements in its construction.

267 – **Trial of a Double-Furrow Turn-Wrest Plough with Lever Adjustment.** — PUCHNER, H. in *Mitteilungen des Verbandes landwirtschaftl. Maschinen-Prüfungs-Anstalten*, Year 7, Part 5, pp. 182-185. Berlin, 1913.

In the introduction to his paper, the writer gives an illustration of this plough and describes it. It differs from similar machines in that the depth and breadth of the furrow can be regulated whilst the plough is working.

One of these ploughs was tried on the Royal estate of Weihenstephan and proved useful and easy to handle. The lever adjustment used while working was recognized as a distinct advantage.

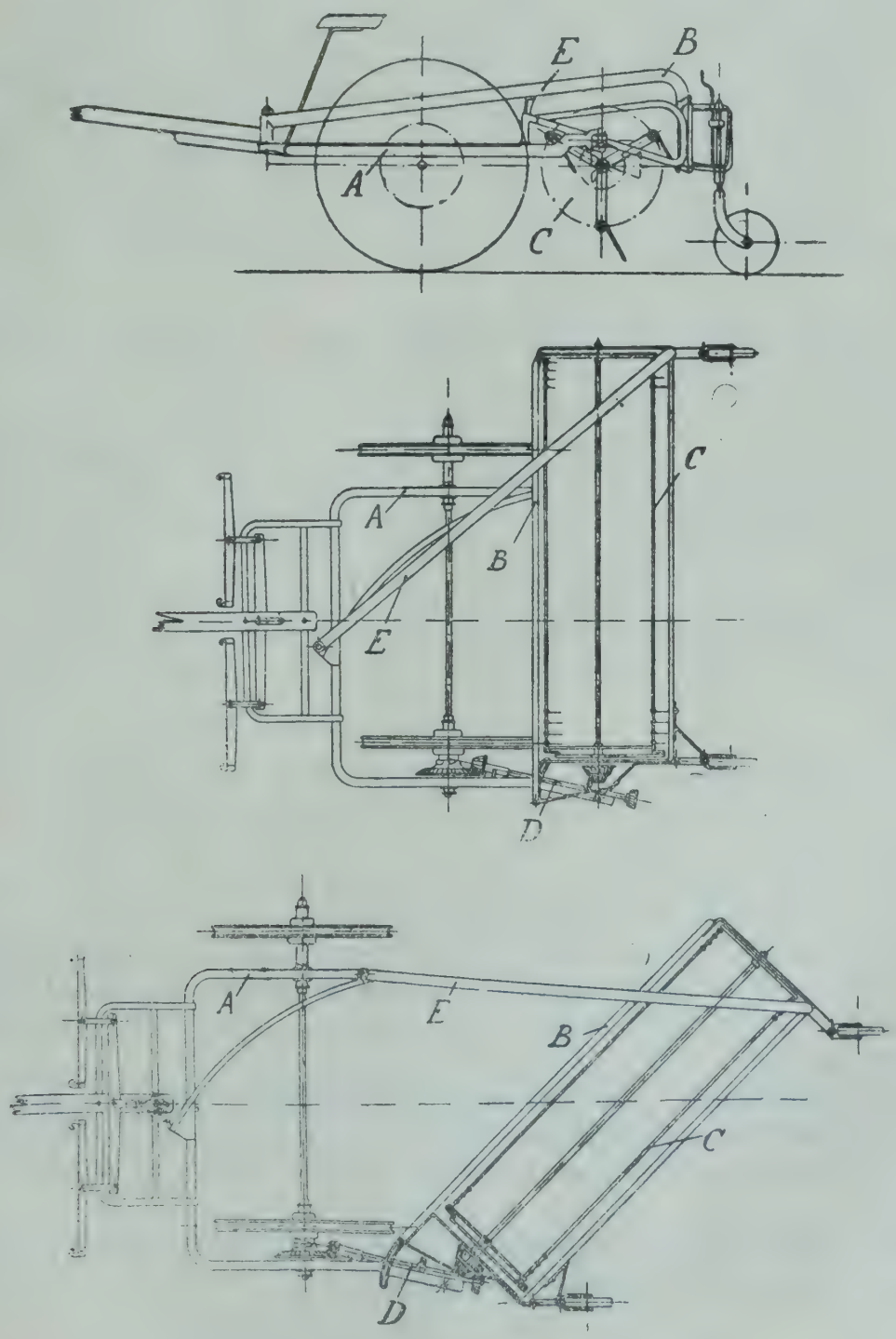
Determinations of the traction power it requires showed that 308 to 396 lbs. are sufficient in loamy soils. The plough can consequently be drawn by two average horses without excessive fatigue. It can be adjusted to depths varying from 1 ½ to 7 inches, and to a maximum breadth of 19 inches. It weighs about 370 lbs. and is most suitable for medium soils. The price of the plough with coulter and reserve share is £6 11s 4*d*.

268 – **Trial of a Combined Hay Tedder and Side-delivery Rake.** (42nd Report of the Machine-testing Bureau of the Chamber of Agriculture for the Province of Brandenburg.). — FISCHER, G. in *Mitteilungen des Verbandes landwirtschaftl. Maschinen-Prüfungs-Anstalten*, Year 7, Part 6, pp. 229-234. Berlin, 1913.

This machine was used during the whole hay season of 1913 on the Gutenpaaren estate. It consists of a frame, *A*, on wheels, connected with another frame, *B*, carrying a revolving rake or tedder, *C*. The position of the tedder can be shifted by moving the frame that carries it round a vertical pivot. When at right angles to the direction in which the machine is drawn it acts as a tedder, when shifted round to an angle of 45° with its former position it acts as a side-delivery rake. The figures show the machine in both positions. The rake is driven by conical gearing on the axle of the front

wheels, and on an intermediate shaft, *D*. The change in the position of the rake is effected by removing a pin in the head of the connecting draught rod, *E*, and turning this round to its new position.

The writer describes the experiments that were made with the machine and gives its most important dimensions and the speeds at which the several parts work. In conclusion, he states that the combined tedder and side-delivery rake worked very well on extensive areas through the whole season without any interruption. It worked satisfactorily also when turning round.



Combined hay tedder and side-delivery rake.

269 – **Theory of the Drum for Threshing Machines.** (Trial of agricultural machines at the Moscow Agricultural Institute). — GORJATCHKIN, W. in *Mitteilungen des Verbandes landwirtschaftl. Maschinen-Prüfungs-Anstalten*, Year 7, Part 5, pp. 185-225. Berlin, 1913.

This paper, which throws light from a purely mechanical point of view on some of the more difficult problems connected with agricultural machines, is intended for specialists in the construction of threshing machines.

The writer deducts the fundamental formula for the work of the drum of the threshing machine, examines it and gives several diagrams of velocities. In order to prove the connection between the motor and the work of the drum, besides these experiments made in 1910 and 1911 a whole series of complementary experiments should be carried out, namely :

1. On the friction of the axles at various numbers of revolutions.
2. On the resistance of the air at various numbers of revolutions.
3. On the slipping of the belts when running empty or with load.
4. On the performance of the motor at various numbers of revolutions.
5. On the effective acceleration of the drum at various numbers of revolutions, and the power of the motor, that is the curve of the increase of velocity when running empty.

270 – **Average Results of Threshing Experiments.** — HAGENSTEIN in *Maschinen-Zeitung*, Year 12, No. 1, pp. 8-9. January 1, 1914.

The writer gives the results which he obtained by some experiments on threshing cereals, in which feeding the sheaves headfirst (Langdrusch) was compared with feeding them sideways (Kopfdrusch). The sheaves were made by a Deering six-foot binder, and thrashed by a good Flöther threshing machine provided with baler and automatic binder.

Barley. - Headfirst feeding. — In one hour 156 sheaves weighing 31 lbs. each were threshed ; the loss of grain was 192 grams per sheaf, or 660 lbs. in 10 hours. Performance per hour, 3527 lbs., weight of straw about 4925 lbs.

Sideways feeding. — In one hour 210 sheaves weighing 31 lbs. each were threshed. The loss was 80 grams per sheaf, or 370 lbs. in 10 hours. The quantity of barley threshed per hour was 4960 lbs., the weight of the straw 6482 lbs.

With this output from headfirst feeding the loss would be 928 lbs., an excess of 558 lbs. over the sideways feeding.

Mixture of one-third barley and two-thirds oats. - Sideways feeding. — In one hour 225 sheaves weighing 27.6 lbs. each were threshed. The loss per sheaf was 33 grams of grain, or in 10 hours 163 lbs. The total threshed was 5126 lbs., the weight of straw being about 6200 lbs.

Headfirst feeding. — In one hour 186 sheaves weighing 27.6 lbs. each were threshed ; they yielded 3803 lbs of mixed grain. The loss per sheaf was 56 grams of grain, or in 10 hours 229 lbs. Weight of straw about 4921 lbs.

Thus the extra loss on headfirst feeding on the quantity threshed in ten hours by sideways feeding was 146 lbs.

271 — **Milk Separator "Göricke R. N. E. 1."**. (8th Report of the Agricultural Machine and Implement Testing Station at Tábor, Bohemia). — CERNY, I. in *Mitteilungen des Verbandes landwirtschaftl.-Maschinen-Prüfungs-Anstalten*, Year 7, Part 5, pp. 177-182. Berlin, 1913.

This milk separator is intended to be worked by hand and for the treatment of about 33 gallons per hour. Its total weight is about 70 lbs. The writer gives a minute description of the machine and of its working, and then reports upon the results obtained at the trials. These were carried out between July 31 and August 24. The chemical investigations were conducted in the laboratory of Prof. R. Truka at the Royal Bohemian Agricultural Academy at Tábor.

The paper contains tables of the data collected during the trials, some of which were made with the milk at 35° C. (95° F.), others at 30° C. (86° F.) and at 25° C. (77° F.) The number of revolutions per minute varied from 70, normal, to 60.

The verdict of the judges was that the separator removes the cream well, its running is smooth and easy and its presumable durability is high.

272. - **Centrifugal Milk Filter "Albissa"**. — *Deutsche Schlacht- und Viehhof-Zeitung*, Year 13, No. 52, pp. 799-800. Berlin, December 28, 1913.

This centrifugal filter is a machine for cleaning milk; it unites the advantages of centrifugation with those of a cotton filter. It is very cheap, requires but little time and power and is also highly recommendable from the hygienic point of view.

The machine consists of a support and the drum proper. The latter has a first strainer in which the coarser impurities are separated out. The drum itself consists of an inner perforated head, round which cotton wool is placed and then stretched and firmly kept in its position by an equally perforated frame. This machine, worked by hand, can easily pass 220 gallons of milk per hour through a single cotton filter; driven by power it can treat as much as 1100 gallons in the same time, purifying the milk mechanically in the most complete manner.

273 – **Revolving Churn with Frame.** — *Deutsche Landwirtschaftliche Presse*, Year 41, No. 4, p. 45. Berlin, January 14, 1914.

The novelty in this churn consists in the pivots round which it revolves being no longer attached to the vessel itself but to a frame in which the churn is placed. The advantages of the machine are the facility with which the vessel can be removed and handled and the easier and smoother running.

The churn is made in different sizes to hold from 15 to 44 gallons, and its price ranges from £ 4 8*s* to £ 6 12*s* 4*d*.

274. - **Potato Drying as Auxiliary Industry for Distilleries.** — DEGEL, R. in *Deutsche Landwirtschaftliche Presse*, Year 40, No. 93, p. 1104. Berlin, November 19, 1913.

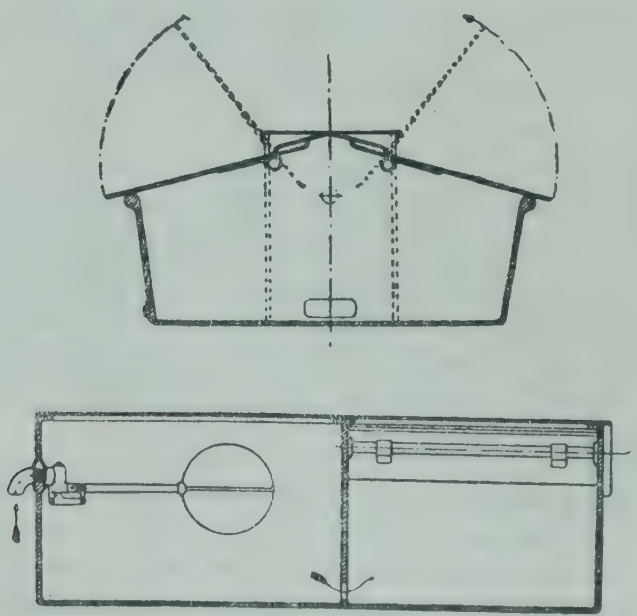
The writer gives an estimate of the working expenses of potato-drying works of various output, attached to distilleries. The great difference in the cost of drying in such works as compared with that of independent drying factories, is chiefly due to the fact that in the former part of the distillery plant can be used, the manager of the distillery can look after the drying, and only one or two extra men are required.

BUILDING CONSTRUCTION.

275 - **Automatic Drinking Trough.** — *Deutsche Landwirtschaftliche Presse*, Year 41, No. 2, p. 17. Berlin, January 7, 1914.

This drinking trough, of which a front view and section are given, has been declared by the German Agricultural Association (Deutsche Landwirtschafts-Gesellschaft) as " new and worthy of consideration ".

It is intended especially for pigs and young stock. It consists of a central reservoir with float and two drinking troughs, one on each side of the reservoir. In order to allow the troughs to be easily opened and noiselessly closed, the covers are provided with counter weights. The main water-pipe communicates with the reservoir by means of a small bore pipe; the water passes from the reservoir into the trough by an aperture in the side between the two. When the animals drink out of the trough and the level of the water sinks in it, the float opens a tap which allows fresh water from the main pipe to flow into the reservoir until the proper level is again reached. The advantages the apparatus presents are that it automatically supplies the animals with the required quantity of fresh pure water, that it is easily and cheaply put up, that all its parts are accessible, and that it is effectually protected against dirt of any kind. Its price is about £ 1.15 *s.*



Automatic Drinking Trough.

RURAL ECONOMICS.

276 – **The Significance of the Fluctuations in the Price of Cereals for the Profitableness of the Moravian Peasant Farms.** — OSTERMAYER, ADOLF in *Oesterreichische Agrar-Zeitung*, Year IV, No. 50, pp. 559-602; No. 51, pp. 611-614; No. 52, pp. 625-627. Vienna, December 13, 20 and 27, 1913.

The writer states that the prices of cereals between 1906 and 1907 underwent a permanent rise, due for the most part to the increase of the customs duty. He examines the effect of the fluctuations in the prices of cereals

TABLE I.

Year	Average price of cereals per cwt.	Average cereal duty	Net returns per acre	Net returns in percentage of capital in farm.
	s d	*s d*	*s d*	
1902	6 11		21 8 1/4	
1903	7 2 3/4		20 7 1/4	
1904	7 0 3/4	1 1 1/2	22 4 1/4	
1905	7 2		22 0	3 per cent and less.
1906	6 11 1/2		21 10 3/4	
1907	8 1 1/2		23 10	
1908	8 10 1/2		25 1 1/2	
1909	9 6 1/4	2 7	25 10	3.25 to 3.5 per cent.
1910	8 4 1/4		23 10 1/2	
1911	9 1 1/4		25 6 1/4	

TABLE II.

Period		Average extent of farm	Value per acre	Net returns		Compens. for work		Total income		Increase of rate of interest	Interest on debts		From net returns interest of debts claims per cent.	Thus less than formerly
				per acre	in per cent. of capital	per acre	in per cent. of capital	per acre	in per cent. of capital		per acre	in per cent. of capital		
		acres	£ *s d*	*s d*		*s d*		*s d*			*s d*			
Before	1907	25.06	44 1 1	12 8	1.43	47 5	5.38	60 1	6.81	—	8 8	0.94	65.7	—
After				15 6	1.75	47 5	5.38	62 11	7.13	+ 0.32			53.7	12.0
Before	1907	47.35	35 18 2	18 6	2.57	25 4	3.52	43 9	6.09	—	6 0	0.83	32.2	—
After				21 10	3.04	25 4	3.52	47 2	6.56	+ 0.47			24.0	8.2
Before	1907	130.84	28 18 6	16 5	2.84	15 6	2.68	32 0	5.52	—	3 7	0.61	21.4	—
After				20 3	3.50	15 6	2.68	35 10	6.18	+ 0.66			17.4	4.0

between the years 1902 and 1911 on the average net returns of 60 Moravian peasant farms. Assuming these farms to send to market an average of only 44.1 per cent. of the cereals they produce, the receipts from the sale of cereals would average only 16.9 per cent. of the total receipts of the farm, yet the increase in the price which took place after 1906 increases considerably the profitableness of the farms, for the rate of interest of the capital invested in them, which up to the year 1906 had been only about 3 per cent., rises above this figure, up to 3.5 per cent.

If the 60 farms be divided according to their altitude into three groups, and then the effect of the increase of the price of cereals upon the profitableness of these groups of farms be examined, it will be found that the rate of interest in the years 1902-06 averaged for the farms situated in the plain about 3 per cent., for the farms situated in the mountains about 1.12 per cent., and for those in an intermediate position about 2.25 per cent.; while for the years 1907-11 the corresponding rates of interest were 3.5, 1.75 and 3 per cent.

In order to ascertain whether the increase of prices was important for the small farms, as well as for the large and medium ones, the writer divides the 60 farms into three groups according to their extent and calculates for each their net returns, the rate of interest on the capital invested in them, the compensation to the members of the owner's family for their intellectual and manual labour, as well as their resulting income for the two five-year periods -- one before the effect of the increased duty and one after, that is before and after 1907. He examines further the effect of the increase of the net returns upon the indebtedness of the farms. The results are collected in Table II.

The smaller the farm the greater is the part taken by the compensation of labour out of the total income and the smaller the rate of interest on the capital. The increased rate of interest due to the increased duty and consequently higher prices of cereals grows with the extent of the farm; nevertheless the slight increase observed in the smallest farms acquires greater importance for the conservation of the property, when it is considered that in consequence of the improvement that set in in 1907 of the ratio between returns and interest on debts, the latter claims 12 per cent. of the returns less than formerly, while in the other two groups of farms this benefit is 8.2 and 4 per cent. respectively. In the paper all these results are grouped in tables and diagrams.

277 – **The Amortization of the Capital in Buildings in Swiss Agriculture.** — TANNER, CARL in *Archiv für exakte Wirtschaftsforschung*, Vol. 5, Parts 3 and 4, pp. 530-583. Jena, 1913.

The writer first defines the problem and then states the opinions on the subject current in agricultural literature. He is opposed to the theory of the fund for a new building and that of the paying off of the cost, and in favour of the simple depreciation theory (according to Laur). Consequently he does not approve of compound interest being used in the calculation of the quota of amortization. This must not, however, depend upon the caprice and requirements of the accountant, but must be based on firm prin-

ciples founded on the real depreciation of the building due to wear and tear and to the effect of economic factors (technical progress, change in the trend of the farm).

With this object in view, it is advisable to decompose the value of the buildings into separate groups, the wear and tear of which follows the same or similar laws. The amortizable parts of the building (in opposition to those that are not to be amortized, namely the site and the value of the materials after demolition) are best divided into two groups, one comprising those parts which last the whole time over which amortization extends, and the other those that have to be renewed once or oftener during the time that the building will last. This latter group can be still further subdivided. The quota of amortization of each group is obtained by dividing its original value by the duration of the corresponding group. The amortization quota of the whole building is then the sum of the quotas of each group. The more extensive repairs (renovation or upkeep repairs) are to be booked as a supplementary value of the corresponding group and amortized like the other parts of the building.

The gradual depreciation of a building caused by technical progress or by the change in the trend of the farm can best be united to the amortizement due to wear and tear by shortening the probable duration of the group of parts that lasts the whole time of the building. This group is the only one really affected by the above depreciation, and shortening the duration correspondingly increases the amortization quota.

The amortization is given in percentages of the original value.

The writer deals then more specially with conditions obtaining in Switzerland in respect of agricultural buildings. By means of question sheets

	Calculated on the basis of extensive subdivision of the capital in buildings into groups	Calculated on the basis of subdivision of the capital in buildings into permanent and renewable parts
	percentage	percentage
Dwellinghouse of the Fricktaler type (North-west Switzerland)	1.25	1.31
» the Berne type	1.47	1.50
» the Freiamt type	1.40	1.38
» the Lucerne type	1.33	1.46
Outbuildings und stable of the Fricktaler house . .	2.22	2.23
» » » of the Berne house	2.59	2.59
» » » of the Freiamt »	2.19	2.62
» » » of the Lucerne »	2.39	2.56
New outbuildings of the transition type of 1880 .	2.52	2.43
New outbuildings, built after 1905	2.47	2.50
Cheese dairy: Dwelling house	1.55	—
Work rooms and cellarage	2.14	—

addressed to farmers, country builders, carpenters and architects, he ascertained the duration of agricultural buildings and their parts and used these data to calculate the amortization percentages. Further, with the aid of the valuations of buildings made by the fire insurance institute of canton Aargau, and considering the various types of Swiss buildings, he calculated first the percentage of the various groups in the total capital invested in buildings and then their quota of amortization expressed in percentage of the original value. The addition of the amortization quotas of the separate groups gives for the whole buildings the amortization percentages of the original value, including the amortization of periodically recurring repairs (see Table. p. 395).

The contents of the question sheet, the answers obtained, as well as the separate and average results of the calculations, are shown in tables.

278 – **Proposals for Reform of the Valuation System based on the Inherent Capacity of the Soil (« Bonitierungstaxe »).** — AEREBOE, F. and BRINKMANN, F. — *Teil II der Vorschläge zur Reform der Taxprinzipien des Kur- und Neumärkischen Ritterschaftlichen und des Neuen Brandenburgischen Kreditinstitutes*, pp. 1-53. Berlin, 1914.

In the first, or theoretical, part of their work, the writers begin by treating the following fundamental question: whether it be well to keep to the present method of valuing land, which consists of a "scheme of valuation based on returns" ("schematisierte Ertragstaxe"), or whether it would not be advisable to substitute for it a capital valuation which does not attempt to determine the total and mortgage values of an estate by the round-about method of calculating the gross returns and working expenses and from them the capitalised net returns, but values directly the kind and amount of capital involved in the estate.

To discuss the question, the actual meaning of "the capitalised value of an agricultural estate" ("Ertragswert eines Landguts") must be clearly defined. It is usually defined as the capitalised value of the mean returns over a number of years. But even leaving aside the fact that, owing to the large annual fluctuations of the net returns, the number of years taken will exert a considerable influence on the mean value of the net returns and therefore on the final result, *i. e.* on the amount of the capital determined, the capitalised value of agricultural estates, like the value of any other source of return in national economy, can only be expressed in terms of future returns, while past returns can only serve to predict *probable* future returns. The capitalised value is therefore only the expression of a future capacity for returns, that is a purely estimated value, obtained not by a single estimate but by a general estimate in the scheme of national economy, and may also be obtained by capitalising all the common values of all future returns from agricultural estates. Therefore the capitalised value and the common value of agricultural estates should be equal.

It follows that equal net returns would not always yield equal capitalised values. In practice there are always a number of factors which cause the money value of equal returns to correspond to a variety of capitalised values which may differ considerably amongst themselves. Such factors are, for example, the different conditions of

credit and taxation in the various countries, for the important point is not the sum total of the net returns, but simply that part of the net returns which the agriculturist receives as rent for his land under identical conditions. Another still more important factor in this connection is the manner in which the purchasing power of a given income from an estate will vary according to the position of the estate, for an estate is not only a means of earning a definite sum of money, but also the place of residence of the agriculturist.

It may be concluded that the net returns as defined by Thaer and Von der Goltz cannot be utilized directly for the valuation of estates, that there is not at present and never has been a capitalised valued obtained from net returns capitalised at a fixed rate.

But all the above factors are automatically taken into consideration in settling the market price of an estate. The writers show how these prices will vary with the returns, future possibilities being considered not only by the purchaser but also by the seller, as the prices only constitute a statement of the minimum returns to be obtained for a certainty by the purchaser. The market price is therefore the only reliable means of estimating the value of an estate, and should always serve as the basis of valuation, whether the question be one of credit, succession, expropriation or taxation. For values are merely a statement of prices, and any valuation established without regard for prices may be set down at once as deprived of a valid base. Therefore all so-called valuations based on returns are of no scientific or practical value.

Over and above the impracticability of the process of valuation recommended by text books on the subject and known as the " detailed valuation based on returns " (" ausführliches Ertragstaxverfahren "), such a valuation could never give reliable results, even if unlimited time could be spent on the work and unlimited knowledge were brought to bear on the subject, because of the inaccuracy of the gross returns estimates, and because of the impossibility of determining exactly the rate at which the net returns are capitalised. The fact that many credit societies have worked successfully for some long time using the scheme of valuation based on returns may be readily explained, as these valuations are not really " valuations based on the returns " (" Ertragstaxen ") but capital valuations (" Kapitaltaxen ") determined on the basis of returns calculated from the interest of the market price, and for which, therefore, the point of departure is a capital value and the end point is the same capital value attained via nominal gross returns, working expenses and net returns, which are then capitalised.

But in such a system of valuation based on returns there is no clear indication as to which part of the total value of the estate constitutes its mortgage value, while on the other hand the capital valuation enables the limit of security (" Kreditwürdigkeit ") of each farm to be determined very exactly. for the principal task of the capital valuation is to determine easily and accurately the value of the land as apart from the total farming capital. Then it is only necessary to add to this value the mortgage value

of the buildings, in order to obtain the total mortgage value and the total limit of security of the estate. Besides, the capital valuation is more easily and better adapted to changes of circumstances than is the valuation based on returns.

Payment of rent in cash is a quite unsuitable basis for a system of valuation of scientific value, for, owing to the variation of the mutual obligations between landlord and tenant, its value is too changeable to form an accurate basis for the estimation of the farmer's capital and much less for the estimation of the total value of the estate.

In the second part of their proposals, the writers outline a scheme of valuation ("Taxrahmen") for the systematic capital valuation, and discuss the manner in which different farms are to be entered according to this scheme.

From the above discussion it will be obvious that it is necessary in the first place to have an accurate knowledge of present prices and of their recent development, if a scheme of valuation is to be established which includes the value of all classes of cultivated soil within the working area of each credit institute, classed according to the crops carried and to the quality of the land. The writers make use of the data on prices, which the Prussian Ministry of Finance began to collect in 1889, to establish a mean value for the farms in the different parts of a single credit institute area, classified according to their size and according to the net returns, which served as a basis of assessment for the land tax.

These data only indicate that portion of the price of estates to be attributed to the bare soil, taking no account of the different crops on these estates, and must therefore be further detailed in order to define that part of the price due to each particular crop; for, as the proportion of the different crops varies largely from one estate to another, and the standards of quality of the different crops also vary, the exact value of agricultural estates cannot be established by means of the systematic capital valuation unless a scale of valuation is established in the first place for the various kinds of crops: *viz.* arable fields, meadows and pastures, and also for forests and freshwater fisheries when required, and, in the second place, for different qualities of land under these different crops.

Such special values may be established on the following basis: 1) that estates with high quality soil usually have little meadowland, and therefore that the soil on such estates furnishes a pure value for arable soil; 2) that it is just on the best soils that both arable fields and meadows are equally well adapted to give the best results, and that therefore the value of the best arable fields also represents a maximum value for meadows, and the same scale of values may consequently be used for both. Pastures may also be treated like arable fields if their soil is of such a quality that they could equally well be turned into arable land, and therefore the values of pastures and arable fields only differ by the cost of turning a pasture into arable land. This cost is negligible in comparison to the value of high quality land; consequently, the value of the best pastures is approximately equal to that of

the best arable land, while poor pastures are worth considerably less than poor arable soil.

In order to allow for the great differences in the economic conditions which exist in the different regions of a large credit institute area, the whole area is divided into regions in which different economic conditions prevail, and supplements are added where optimum conditions exist in the subdivisions. These supplements are calculated from the difference of value between the best and worst economic conditions and may amount to 70 per cent. of this difference at a maximum, while they should never be under 5 per cent. of the smaller value itself, increasing inversely with the quality of the land and directly with the size of the farm.

It is also necessary to add supplements where specially good conditions prevail in the case of meadows, but these are much smaller when valuation is based on the quality of the land ("Bonitierungstaxe") than when it is based on the net returns which serve as a basis of assessment for the land tax ("Grundsteuerreinertragstaxe").

As to the standard by which the land is allotted to the different classes in the scheme, the writers not only allow for the composition of arable soils as judged by their principal constituents, but also for their suitability to the principal crops. Arable soils are divided into eight classes, each having a different money value. Meadows are also divided into eight classes chiefly according to their water supply and to the quantity and quality of their hay. Forest soils are divided into five classes, chiefly according to their suitability to certain forest species and to the character of their underwood, the latter character being also a good indication of the condition of their water supply. In establishing this scale of values for forest soils, the writers have not, however, made use of the market price of the estates, but of the price which these would fetch if sold to the forest administration. The freshwater fisheries are divided in the first place into natural waters, which cannot be run dry, and artificial lakes which can; the latter are again subdivided into four classes according to the ease with which the water supply can be controlled and to the nature of the land, while the natural waters are subdivided into three classes according to the quality of their fishing.

As to the allocation of the estates in the different economic zones, it is convenient to separate the agricultural area (arable fields, meadows, and pastures) from the forest area, and both from the area of freshwater fisheries, dividing each group into four zones. In subdividing the agricultural area into its four constituent zones, the distance from the market, the means of communication, and the price of agricultural produce, more especially that of fresh milk sold off the farm, are used. In subclassifying the forest area into its constituent zones, the price of the wood is of chief importance, position and the condition of the forest roads being of minor importance.

For unfavourable conditions which cannot be taken into account in the various classes and zones, such as occur, for instance, when crops are intermixed instead of being continuous, or when fields of one farm are mixed with those of another farm, when the supply of drinking water is not

good, etc..., suitable deductions may be made from the established mortgage value of the land; these deductions must not exceed certain limits which are defined by regulations. Deductions from the amount of credit to be granted should also be made for a faulty economic condition of the farm, for by this means the number of forced sales would be reduced, and it would also prevent the mortgages on such incompletely equipped estates from exceeding two-thirds of the value estimated by the "Landschaft" (agricultural credit association), a proceeding which is contrary to the laws and statutes of those credit institutes.

The mortgage value of buildings is best estimated from the values fixed by fire insurance societies and from the normal relationship between the value of the living-house and that of the farm buildings on the one hand and the normal relationship between the value of all the buildings and that of the land on the other. These normal relationships may be altered by the addition of supplements in cases where industrial plant or numerous cottages in a good state of repair exist on the estate.

279 – **An Example of Agricultural Book-keeping on the Card System.** — GUFFROY, CH. in *Journal d'Agriculture pratique*, Year 78, Vol. 1, No. 1, pp. 13-16. Paris, January 1, 1914.

The writer discusses the advantages of this system, which can be used with all the usual systems of agricultural book-keeping, and which consists in writing on separate cards all the events of the farm, commercial transactions, single accounts, etc. With the aid of an actual example, he illustrates the entries on the cards and the method of using them.

AGRICULTURAL INDUSTRIES.

DAIRYING.

280 – **The Condition of the Dairy Industry in the Argentine Republic in 1912.** — *Communication from* EMILIO LAHITTE, *of the Ministry of Agriculture of the Argentine Republic, Bureau of Statistics and Rural Economy.*

A simple comparison of every series of statistical data on the dairy industry in the Argentine Republic during the year 1912 with those of the preceding year shows that the normal condition of live stock during 1912 was accompanied by good results as regards production, and much superior to that of 1911. The figures are shown in the table.

Raw material. — Of the 68 ½ million gallons of milk in the industry, the province of Buenos Aires supplied 71 per cent. During the year in question the prices per gallon varied from 2.8 *d* in December to 7.1 *d* in July (prices at the farm). Considering an average price of 3.8 *d* per gal., the total value of the raw material amounted to £1 089 000.

Cream. — As is to be expected, theprovince of Buenos Aires is the greatest contributor under this head : 23 112 000 lbs. out of a total of 37 455 500 lbs. (61 per cent. of the whole). The relatively short distances from the federal capital, the easy means of communication and the presence of important centres of consumption, explain the great number of cow farms and

	1911	1912	Increase in 1912 over 1911
			per cent.
Production of:			
Cream . . . . . lbs.	26 605 000	37 455 500	40.8
Butter . . . . . »	17 427 000	21 818 500	25.2
Cheese . . . . . »	7 305 000	12 416 000	60.2
Ewe's milk cheese . . . . . »	?	110 000	—
Casein . . . . . »	?	11 590 000	—
Number of:			
Milk dairies	1 160	1 259	8.5
Cream »	398	525	31.9
Butter »	10	16	60.0
Cheese »	158	129	22.5
Mixed »	329	369	12.2

dairies in the province of Buenos Aires; in the province itself, however, the dairies are mainly in the southern and western districts within about 200 miles of the capital.

Butter. — The four great butter manufactories established in the capital turned out 13 586 500 lbs., that is 62 per cent. of the whole output of the country. The average sale prices at the works varied considerably according to the season, as is shown by the following data :

1912	*s*	*d*
Price of butter per lb. in:		
January, February and March	1	0
April	1	0 1/4
May	1	1
June and July	1	7
August	1	3 3/4
September	1	0
October		11 1/2
November		10 1/4
December		9 1/2

As the prices between April and August may be considered exceptional on account of the drought, which to a great extent diminished the production, a price of 1*s* 1 1/4 *d* is taken as an average for the whole of 1912. The total value of the butter is thus £1 207 000.

Cheese. — In this item the increase of the quantity produced in 1912 over that of 1911 is considerable (12416 300 lbs. against 7 745 900 in 1911). The provinces of Buenos Aires and Cordoba contributed largely to this increase, especially the latter, in which the yield rose from 758 568 lbs. in 1911 to 1 412 276 lbs. in 1912. The price at the dairies may be valued at

5 3/4 *d* per lb., which would give the value of the cheese produced in 1912 as £294 400.

It would be difficult to state exactly the type of cheese that is produced. Nevertheless it may be said that, excepting such cheeses as Tafi, Chebut and the like, there is no commercial type, and in general only very successfull imitations of all known kinds are manufactured. Still the figures which will be given below show that these imitations do not prevent considerable importations and that the Argentine consumers prefer the original cheeses of certain determined countries. In fact the imports of all cheeses during the five years 1908-12 amounted to 49 200 000 lbs., worth £1 767 500. In 1912 the imports were 11 849 000 lbs., worth £425 667. As for the countries whence the cheese is exported, Italy has an undoubted supremacy, having supplied 79.3 per cent. of the total in 1912; next follow Switzerland, Holland, France.

Casein. — In view of the increasing importance of the production of this substance, the statistics have minutely investigated its output. The production of 11 590 000 lbs. shows to what an extent the industry has availed itself of skimmed milk in order to meet the steady demand for this substance, which has successfully replaced other industrial products, and which, owing to the prices it commands on the market, yields a fair net profit to the producers.

The province of Buenos Aires is the chief producer of casein. Out of a total of 11 590 000 lbs., it has supplied 5 214 500 lbs., or 45 per cent.; it is followed by the Federal capital with 4 189 000 lbs. and Santa Fé with 1 573 250 lbs. The following table, which shows the quantities exported from Argentina during the last five years, gives an idea of the future there is for this industry :

	lbs.	Value
1908	8 461 300	£35 860
1909	6 117 100	48 350
1910	6 553 600	51 800
1911	4 780 300	37 780
1912	7 717 100	60 990

According to commercial information, the value of this substance at the works may be estimated at £138 600, or £26 10*s* per ton.

Whey. — On the answers received to an enquiry, 75 per cent. state that whey is used in the feeding of pigs, that is in the production of pork. It is not easy to determine the value of the whey thus transformed, notwithstanding the fact that the quantities used for this purpose are known ; there is no doubt that it runs up to some thousands of pounds.

Summarizing, the values for 1912 work out as follows :

Value of the butter	£1 207 000
» » » cheese	294 500
» casein	138 500
» (calculated) of the other products and by-products	23 000
Total value of the produce of the dairy industry	£1 663 000

281 – **The Decomposition of Milk Proteins by Lactic Ferments.** — De Graaff, W. C. and Schaap, A. in *Annales des Falsifications*, Year 6, No. 62, pp. 639-645. Paris, December 1913.

In working out a new method for the quantitative determination of the proteins in milk the writers ascertained that the aldehyde index of buttermilk averages 1.5 times greater than that of fresh milk. The cause of this is assumed to be a decomposition of the protein in the buttermilk. Recent investigations made in this direction have confirmed this assumption and shown that fresh milk never contains albumoses and peptone, which are always found in buttermilk. In order to ascertain through what agency protein was decomposed, the writers investigated the effect of rennet and of lactic acid upon the aldehyde index of milk. It appeared that even after 24 hours rennet has no effect upon the aldehyde index; nor did lactic acid, alone or combined with rennet, have any. It can therefore be assumed that the decomposition of protein is not accomplished by rennet or by lactic acid but by the micro-organisms in the milk.

The writers consequently studied the growth of the microflora, both with the exclusion and with the admittance of air ; then they treated fresh milk with buttermilk and finally they isolated lactic acid bacteria (cocci and bacilli) from buttermilk and introduced them into sterile milk. The result was that both in the presence and absence of air nearly the same milk flora developed, from which the conclusion to be drawn was that it consisted mainly of lactic acid bacteria. The addition of butter milk to fresh milk was regularly followed by an increase of the aldehyde index of the latter. The inoculation with lactic acid bacteria isolated from buttermilk caused after a short time a decomposition of protein in sterile milk.

From the above observations the writers draw the following conclusions :

1. The aldehyde index of buttermilk is higher than that of fresh milk, which is to be attributed to a decomposition of the protein in buttermilk by lactic acid bacteria (principally cocci and bacilli).

2. Besides lactic acid bacteria, milk contains other proteolytic bacteria, but these are in too small numbers to alter the aldehyde index.

282 – **Composition of Ewes' Milk Butter.** — Martin, M. in *Annales des Falsifications*, Year 6, No. 62, pp. 662-663. Paris, December 1913.

The writer communicates the results of analyses of ewes' milk butter prepared in the district authorized laboratory at Rodez (Aveyron, France). The fresh milk was supplied by an inspector of the dairies of the " Société des Caves et Producteurs réunis " of Roquefort. It came from the flocks of four farmers whose respectability was a guarantee of the purity of the milk. The samples were obtained from two of the farms each week, so that the same milks returned to the laboratory once every fortnight.

Ewes' milk butter is generally very white, soft and difficult to work and to dry. Its defective appearance banishes it from the table, in spite of its fine taste. It is not rare, however, to find it mixed in various proportions with cows' milk butter on the markets of the Roquefort cheese district. It is very suitable for cooking and for pastry.

Its chemical composition is very nearly the same as that prepared from cows' milk, but the content of insoluble volatile acids and saponification value are decidedly higher. There are nevertheless considerable variations. It is certainly impossible to characterize by means of these data alone a mixture of cows' milk and ewes' milk butters, and still less to determine the proportion of each. The following table shows the figures found by the writer in ewes' milk butter.

	Volatile acids					Total soluble acids		Values		Deviation of oleorefractometer	Refractive index
	soluble *	insoluble	ratio $\frac{i}{s} \times 100$	solubles (Reichert)	insoluble in $\frac{Na\ OH}{10}$	$\frac{Na\ OH}{10}$ in cc.	in butyric acid, per cent.	saponification	Crismer		
Average .	5.26	0.84	15.6	28.48	4.40	23.6	12.5	231.58	54.86	— 29	1.45215
Maxima . .	5.88	1.07	19.7	31.82	7.01	27.9	14.73	242.60	59,99	— 24.5	1.4532
Minima . . .	4.67	0.67	11.5	25.65	2.53	21.6	11.4	216.31	47.09	— 33	1.4511

* The figures of the first three columns were found by Muntz-Coudon's method and those of the other columns by the official method.

MEAT INDUSTRY.

283 – **Composition and Properties of Some Casein and Paracasein Compounds and their Relations to Cheese.** — VAN SLYKE, L. and BOSWORTH, A. W. — *New York Agricultural Experiment Station, Technical Bulletin* No. 26, pp. 1-32. Geneva, N. Y., December 1912.

Two new compounds of casein and paracasein (casein precipitated by rennet) with calcium have been prepared and are described. The new compounds contain smaller amounts of base than any other known compounds, and the writer suggests their being called " mono " and " di-basic caseinates " or " paracaseinates ". Mono- and di-basic salts of barium and strontium were also prepared and mono-basic salts of ammonium, sodium and potassium.

The paracaseinates contain twice as much base as the caseinates and the valency of the latter appears to be 8, while that of the former is only 4, which seems to suggest that the action of the rennet enzyme is to split the casein molecule into two.

A protein formed in the process of manufacture of Cheddar and other cheeses and soluble in a 5 per cent. salt solution is identified with mono-calcium paracaseinate.

284 – **The Amount of Bone in Animals for the Slaughterhouse.** – TRIDOR in *L'Hygiène de la Viande et du Lait*, Year 8, No. 1, pp. 18-22. Paris, January 10, 1914.

The proportion of bone (that is the ratio of the weight of the bones to the total weight of flesh and bones) in animals taken to the slaughterhouses is very variable ; the weight of bone reaches and sometimes exceeds one-third of the total weight of the animal. In full-grown cattle, which have

been most studied from this point of view, the percentage of bone varies with the breed.

The writer has made investigations on calves and sheep in order to ascertain whether there was any connection between the weight of bone and the age, quality and weight of the animals.

1. *Influence of age.* — An examination of the carcases of nine calves which had been seized in the Paris market because too young, showed that the percentages of bone varied from 29.6 to 33.4, while in other somewhat older calves the lowest proportions found were 20.6 and 21.9 per cent, or a difference between the extreme cases of 12.8 per cent.

With sheep, a first series of observations bore on 12 animals which had been seized for their cachexy and leanness. The extreme percentages of bone were 30.4 and 26.9, the average for six lambs and a young ewe being 34.2 and that for five older sheep 29.6 In a second series of observations on animals of good quality, one lamb was found which yielded 24.25 per cent. of bone, whilst two older ewes and one ram gave respectively 15.2, 16.7, and 18.4 per cent., or an average of 16.75 per cent.

In calves and sheep it thus appears that the proportion of bone is higher in the younger animals.

II. *Influence of quality.* — As for calves, various weighings have given the following results :

	Percentages Extremes	Average
9 young calves of very poor quality	29.1 — 33.4	31.8
3 calves of poor quality	26.8 — 29.6	28.25
3 » of 2nd and 3rd. quality	24.3 — 27.7	26.1
3 » 1st class quality	20.6 — 26.2	22.9

In mutton the proportions of bone were:

	Percentages Extremes	Average
6 lean and cachetic lambs	30.4 — 36.1	33.9
6 » » » wethers and ewes	26.9 — 36.4	30.75
1 lamb, 2nd quality		24.25
4 wethers or ewes, 1st quality	15.2 — 22.3	18.15

It thus appears that in calves and sheep the quantity of bone varies inversely with the quality of the animals.

III. *Influence of the weight of the animals.* — The weights recorded in the preceding experiments afford information as to the connection between the quantity of bone and the total weight of the animals. The calves yielded the following results.

	Percentages Extremes	Average
6 calves weighing less than 44 lbs.	30.6 — 33.4	32.5
3 » » from 44 to 66 lbs.	29.6 — 32,2	30.5
6 » » » 66 to 132 »	24.3 — 29.6	27.2
» » upwards of 132 lbs.	20.6 — 21.9	22.9

Examinations of legs of beef have shown that the decrease of the percentage of bone continues sensibly with the increase of the weight of the animal.

With wethers the following figures were obtained :

	Percentages Extremes	Average
9 animals weighing less than 22 lbs.	24.3 — 36.1	31.7
5 » » between 22 and 44 lbs. . .	22.3 — 36.4	29.8
3 » upwards of 44 lbs..	15.2 — 18.4	16 75

The results obtained appear constant with calves, grown up cattle, and sheep, and may be summarized as follows: the proportion of bone to the total weight of the animal varies inversely with the age, the quality and the weight.

PLANT DISEASES

GENERAL INFORMATION.

285 – **Diseases and Pests Legislation in Ceylon.** — PETCH, T., in *Department of Agriculture, Ceylon, Bulletin* No. 6, pp. 79-93. Colombo, 1913.

LEGISLATIVE AND ADMINISTRATIVE MEASURES.

At the present time there are in Ceylon two Ordinances dealing with local plant diseases and preventing the introduction of others. It was not until 1901 that some simple form of legislation was considered necessary to regulate the importation of plants and seeds. Before then these was no law dealing with plant diseases, while other tropical colonies were taking measures against the coffee leaf disease in Ceylon. Since then progress has been rapid, and Ceylon has outrun other tropical countries in adopting a general Ordinance to provide against diseases occurring in the colony.

The writer gives the full text of the legislative provisions concerning plant diseases as outlined in " Ordinance No. 5. of 1901 " entitled " An Ordinance to make provision for preventing the introduction and spread of Insect or Fungous Pests or Plant Diseases ", known as " The Insect Pest and Quarantine Ordinance ". Next follow the various regulations in connection with the said Ordinance extending over the period 1901-1912 to prevent the introduction into Ceylon of fungus diseases and animal pests from other regions and for the institution of a Fumigating Station.

As a result of the regulations already in force, the importation of cacao plants from the Dutch East Indies and pepper from India is absolutely prohibited. All plants, bulbs, etc., except those imported for local consumption, oranges and other citrus fruits and cotton seeds, are subjected to fumigation by means of hydrocyanic acid, unless certified as having been previously subjected to such treatment. Tea seeds are disinfected by means of formalin vapour. During 1912, 1148 cases of oranges and lemons, 4977 cases of tea seeds and 565 consignments of bulbs, plants, etc., were fumigated.

Internal Legislation was contemplated in " Ordinance No. 6 of 1907 ", known as " The Plant Pests Ordinance of 1907 ", of which the whole text is given, representing the result of discussions held by those affected during various years. The " Ordinance " is accompanied by certain Proclamations issued at various imes during 1907 to 1913 describing the methods of controll-

ing fungus diseases and insect pests. Since these Proclamations have not been repealed, power has been given to the Plant Pests Board, set up in each district by the " Ordinance of 1907 " to take steps for the control of coconut beetles, in particular *Rhynchophorus signaticollis* (the red coconut beetle) and *Oryctes rhinoceros* (the black coconut beetle) against the stem-bleeding disease of the coconut (*Thielaviopsis ethaceticus*), against the shot-hole borer (*Xyleborus fornicatus*) and Hevea canker (*Phytophthora Faberi*).

286 — **List of Proclaimed Noxious Weeds in Tasmania.** — *The Agricultural Gazette of Tasmania*, Vol. XXI, No. 11, p. 437. Hobart, 1913.

Botanical name	Local name	When proclaimed
Cnicus arvensis Hoffm.	Californian thistle	29 Oct. 1883
Xanthium spinosum L. (1).	Bathurst burr	20 Dec. 1887
Lepidium Draba L.	White weed	29 Oct. 1908
Cryptostemma calendulaceum Br.	Cape weed	31 Aug. 1909
		17 Nov. 1909
		20 Dec. 1910
		11 May 1911
Arctium Lappa L.	Great burdock	1 July 1910
» *minus* Bernh.	Lesser burdock	
Asphodelus fistulosus L.	Wild onion	29 Sept. 1910
Brassica Sinapistrum Boiss.	Charlock	20 Dec. 1910 *
Conium maculatum L.	Hemlock	3 Feb. 1911
Echium vulgare L.	Viper's bugloss	4 March 1912
Dipsacus sylvestris Mill. (2).	Teazel	21 March 1912*
Anthemis Cotula L. (3)	Stinking mayweed	27 March 1913*
Carduus pycnocephalus Jacq. (4).	Slender or shore thistle	14 Oct. 1913*

* Proclaimed only in certain municipalities.

287 – ***Carduus pycnocephalus* a Proclaimed Weed in Tasmania.** — BLACK, R. A. in *The Agricultural Gazette of Tasmania*, Vol. XXI, No. II, pp. 430-435, figs. 1-2. Hobart, 1913.

As the outcome of a strong recommendation made by the Clarence Board of Agriculture to the local Council, the slender thistle (*Carduus pycnocephalus*) was proclaimed a noxious weed under Section 6 of the Local Government Act, 1906.

This species has been found in many parts of Tasmania, particularly near the coast or even growing on the beach, whence the name of " shore

(1) See also No. 1403, *B.* Dec. 1913. — (2) See No. 1363, *B.* Sept. 1912. — (3) See No. 1096, *B.* Sept. 1913. — (4) See below, No. 287. (*Ed.*).

thistle " sometimes given to it. If left undisturbed it will grow with great rapidity and spreads very quickly owing to the various ways by which its seed is dispersed. Repeated observations show that cattle only eat it accidentally mixed with other fodder, or in times of shortage.

In consequence of the law it is incumbent upon the municipality of Clarence to take action for its eradication. Section 3 of " The Californian Thistle Act, 1883 " (47 Vict, No. 17), as read with Subsection XII of Section 130 of " The Local Government Act, 1906 " provides : — " If any occupier of land within (the Municipality of Clarence) upon which land (Slender Thistle) shall be growing at any time shall not effectually cut down all such (Slender Thistle), so as to prevent the same from blossoming, every such occupier shall be liable to a penalty not exceeding Twenty Pounds ".

Section 3 of " The Californian Thistle Act Amendment Act, 1887 " (51 Vict., No. 29), as read with Subsection XII of Section 130 of " The Local Government Act, 1906 ", forbids the removal or sale of hay, straw, grass seed or any kind of grain containing seeds of slender thistle.

Finally " The Federal Quarantine Act " prohibits the importation of the plant or its seeds from any part of the world into the Commonwealth of Australia under a severe penalty.

DISEASES NOT DUE TO PARASITES AND OF UNKNOWN ORIGIN.

288 – **On " Kroepoek " of Tobacco in Kamerun.** — LUDWIGS, KARL in *Berichte der deutschen botanischen Gesellschaft*, Vol. XXXI, Part 9, pp. 536-543, figs. 1-3. Berlin, 1913.

In the spring of 1913, a tobacco disease which had already appeared in the previous spring, and was known to tobacco cultivators under the name of " Kräuselkrankheit " (leaf curl), was very prevalent in Njombe. From observations made on the spot, the writer ascertained that the disease in question was not the true " Kräuselkrankheit ", but " Kroepoek ", which at first sight appears very similar to the former affection ; according to Peters it occurs in Java, and more rarely in Sumatra, while it is probably present in Ceylon. The cause of this disease, together with the means of its control, have so far not been discovered.

Already on the young plants the central leaves are seen to develop abnormally, since instead of assuming a vertical position as in healthy plants, they curve partially, rotating horizontally. The upper surface of the leaf has a wrinkled appearance, while the nerves on the lower surface are especially marked and show on their margins excrescences of dark green tissue. The leaves no longer develop normally in length, but give the impression of being contracted into themselves ; further, they are not straight, but bent, and subsequently the interposed foliar tissue forms protuberances which are directed upwards. In the older leaves, the excrescences have the appearance of leaflike appendices, having an anatomical structure differing from that found in the normal organ. The size and shape of these outgrowths vary, but they are always connected with the principal nerves,

or with the more marked secondary ones. The development in length of the whole plant is arrested, infected individuals only attaining to about one third of their normal height, while their leaves are valueless to the grower.

Microscopic investigations have not revealed the presence of any bacteria, fungi or insects. Various experiments were also made with potassic manures ; these, however, gave no results. The soil upon which the tobacco plantations have been made consists of decomposed basalt and is very fertile. The alternation of good with bad crops (from the autumn of 1911 in which the first sowings were made, until the spring of 1913), according to whether the tobacco was planted after the rains, or at the close of the dry season, an alternation which was proved to occur not only at Njombe, where there are the oldest and largest tobacco plantations, but also at Mbanga and Ebunje (Ebinse), strengthened the writer's belief that the degree of humidity of the soil exercises an influence upon the appearance of " Kroepoek ", in so far that it is a physiological disease depending on disturbance in the nutrition of the plant. These disturbances, in the opinion of the writer, are connected with the peculiar structure of the soil. The subsoil of the plantations attacked by the disease consists of masses of rock of varying size covered by a stratum of fine volcanic ashes, which at Penja attains a depth of about 20 m. (66 ft.) These ashes, although in themselves very fertile, possess the disadvantage of being permeable to water to an extraordinary degree. The sources of all the streams in the district are situated at great depths, and occur at the spots where the masses of rock crop out. It is impossible to dig a well in the plantations on account of the rocky subsoil.

This peculiar structure of the ground prevents deeply seated water from reaching the surface by capillarity ; to this must be added the method by which the soil is prepared previous to the planting of the tobacco. All the district is covered by a thick virgin forest which assures to the soil a certain amount of moisture. In order to make a tobacco plantation, it is necessary to fell the virgin forest and completely clear the ground by working it repeatedly. It is easy to understand that the soil loses the greater part of its moisture during these operations, especially in the dry season, and dry soil, as is well known, only acquires moisture with great difficulty. Such are the conditions under which the tobacco plantations occur. After the first felling of the forest, which usually took place towards the close of the dry season, the soil still held sufficient moisture ; the atmospheric precipitations of the rainy season followed, and a good crop resulted. Afterwards, the soil was exposed to the sun, the water evaporated without being replaced and the plants consequently became diseased.

According to the writer, the appearance of the disease may be explained as follows. The tobacco plants are first grown in seed plots, whence they are later transplanted to the field. In order to facilitate their taking root, they are generally watered, so that they may continue growing and attain a certain height. After this, the watering is suspended, and the plants are left to themselves. In this condition they form organic substances in

their leaves, through assimilation, but they no longer receive mineral substances from the ground, as the necessary water is lacking. Consequently, the water-conducting vessels do not develop normally, the leaves become shrivelled, and the excess organic substances are used in the formation of the excrescences and the appendices which are observed on the leaves.

It is noteworthy that, at least according to the researches hitherto made, the plant which has once become diseased never regains its normal development, even if subsequently supplied with water.

The observations made exclude the possibility of affected plantations yielding any crop the same season.

In 1913, the writer advised for the control of the disease, the covering of the soil, after clearing it, with about 18 inches of cut grass ; this decomposes forming humus, and thus preserves the moisture for a long time. The results of these experiments are awaited with interest. In any case it would be foolish to abandon tobacco growing, even if a bad harvest is obtained after a moderately wet rainy season, such as was experienced in 1913.

In the Esosung plantations, on the other hand, the soil is also volcanic, but as it contains clay it retains water better. Further, the humidity of the air its such that the soil cannot possibly dry up. In this district, the disease has not made is appearance, and it is possible to plant two tobacco crops in the year.

The writer states, in conclusion, that " Kroepoek " does not only attack tobacco, for he has met with it to a considerable extent also upon plants of " makabo " (*Colocasia antiquorum*) growing upon dry soil near the village of Lum. Doubtless the disease could also be recorded as attacking other plants.

289 – **On the Pathological Significance of Endocellular Fibres in the Tissues of the Vine** (1). — MAMELI, EVA in *Atti dell'Istituto botanico dell'Università di Pavia*, Series II, Vol. XVI, pp. 41-45. Milan, 1913.

According to what is reported in this second note on the subject (the full results of the complete investigations will be published later) the search for endocellular fibres in the healthy tissues of numerous species of " perfectly healthy " dicotyledons has given the writer positive results.

Further, more or less numerous endocellular fibres have been found in the tissues of healthy vines which have been cultivated under the most diverse climatic conditions, from a mountain 650 metres (2170 ft.) above sea-level down to a hot-house.

Contrary to the opinion of Petri, it seems evident, according to the writer, that no correlation exists between the presence of endocellular fibres and any pathological condition of the plant containing them, nor is there any connection between this phenomenon and falls of temperature.

(1) See No. 1207, *B.* Oct. 1913; No. 1394, *B.* Dec. 1913. (*Ed.*).

BACTERIAL AND FUNGOID DISEASES.

FUNGI.

290 – **The Hereditary Transmission of Rust in Hollyhock *(Althaea rosea)*.** — BLARINGHEM, L. in *Comptes-Rendus hebdomadaires des Séances de l'Académie des Sciences*, Vol. 157, No. 26, pp. 1536-1538. Paris, December 29, 1913.

Seeds of *Althaea rosea* sterilised externally and grown in sterile tubes containing Knop's solution (either liquid or solidified by Japanese isinglass) gave rise to plants quite free from pustules of hollyhock rust (*Puccinia Malvacearum*). The addition of 5 per cent. of glucose to the nutritive solution caused the appearance of pustules on the cotyledons several days before they withered off. An addition of 5 per cent. of saccharose gave more vigorous plants, and the pustules appeared on the first leaf when it was drying off. The supply of glucose and saccharose was arranged so that the plants were in a medium physiologically poor in water (Schimper). The writer considers that the above results can only be attained when the illumination is as intense as the walls of the vessel will permit.

BACTERIAL AND FUNGOID DISEASES OF VARIOUS CROPS

291 – **The Fungi causing Straw Blight of Wheat in France.** (1) — PRUNET, A. in *Comptes-Rendus hebdomadaires des Séances de l'Académie des Sciences*, 1913, 2nd Half-year, Vol. 157, No. 22, pp. 1079-1081. Paris, 1913.

Straw blight in France has so far only been considered in relation to wheat; it has been regarded by Prillieux and Delacroix as chiefly due to *Ophiobolus graminis* Sacc., although Mangin and Fron consider the pathogenic agent to be almost exclusively *Leptosphaeria herpotrichoides* De Not. In Central Europe, and more especially in Germany, it appears that *O. herpotrichus* (Fries) Sacc. is chiefly responsible for straw blight in wheat and barley, while *L. herpotrichoides* produces straw blight in rye.

The presence in France of *O. herpotrichus* has not been recorded by the observers of straw blight, with the exception of Delacroix who mentions it incidentally, and the part played by this species in the development of the disease in that country has not been investigated. Nevertheless, *O. herpotrichus* was almost the only species observed by the writer in the district of Toulouse in 1912-1913. In particular, this fungus caused much damage at Saint-Jory and at Ondes (Haute-Garonne). The writer also almost inveriably found it alone on diseased wheat straw from Causé (Tarn-et-Garonne) and Castillonnes (Lot-et-Garonne). He is of opinion that *O. herpotrichus* is also present in other grain-growing districts of France, and in fact, it was recorded in Poitou and from various places in Charente Inférieure in 1856 and 1884 respectively, throughout the Vosges in 1845, and frequently near Paris (at Versailles and Fontainebleau) in 1863.

In the season of 1912-13 *O. graminis* took the place of *O. herpotrichus* in the neighbourhood of Queyssac (Dordogne). In all the above-mentioned places *L. herpotrichoides* has rarely made its appearance. Mangin, and subsequently Fron, have, however, found this species abundant elsewhere.

(1) See also No. 77, *B.* Jan. 1914. [*Ed.*]

Wheat straw blight in France is there fore usually due to one of the three following species : *O. graminis, O. herpotrichus, L. herpotrichoides.* It would be premature to state the relative importance of these three fungi as pathogenic agents. Further, there is no proof that the species which predominates in a district at any given moment will always predominate there.

Hence it results that the name of " piétin " is in fact given to three different diseases, and this confusion in nomenclature gives rise to serious difficulty, since it causes the confusion of facts. The three straw blights possess as their common characteristic the habit of invading the base of the haulms, but the study of their life-history is too little advanced for it to be possible to determine with any certainty the points in which they differ from one another.

It has already been observed that their organs of reproduction are not formed at the same time, and that the different species have a preference for wheat, rye or barley respectively. The writer adds that oats, which, according to Mc Alpine and Robinson, are immune to *O. graminis*, have in theneighbourhood of Ondes been very severely attacked by *O. herpotrichus*. Without doubt, these are not the only differences ; they are, however, sufficient to show that each straw blight should be studied independently of the others.

INSECT PESTS.

GENERALITIES.

292 — **The Insect Fauna of the Soil.** — CAMERON, ALFRED E. in *The Journal of Economic Biology*, Vol. 8, No. 3, pp. 159-204, plates I-II, figs. A-C. London, September 29, 1913.

The writer has made a thorough investigation of the insects inhabiting the soil of a grass field attached to the Economic Zoology Laboratory of the University of Manchester. The surface soil is much mixed, but is everywhere underlain by stiff clay. Much of the area was dug over to a depth of 1 to 2 feet, and carefully sifted.

The herbage of the field was composed of a number of grasses and weeds. Larvae of insects found feeding on the roots of the useful grasses and Leguminosae were as follows :

Dactylis glomerata : Hepialus humuli, Leucania comma.

Festuca duriuscula and *F. elatior : Dolerus gonager, D. haematodis, D. picipes.*

Poa annua and *P. pratensis :* Cecidomyidae, Mycetophilidae, Tipulidae (prevalent *Dicranomyia chorea, Trichocera hiemalis, Pachyrrhina imperialis, Tipula oleracea*), Bibionidae (especially *Dilophus febrilis ;* also *Bibio hortulanus, B. laniger* and *B. johannis*) ; Muscid Diptera (*Onesia sepulcralis, Pollenia rudis, Hyetodesia incana, H. populi*) ; Elateridae ; *Otiorrhynchus picipes, O. sulcatus, Barynotus obscurus;* various species of Noctuidae (*Triphaena, Xylophasia, Hadena, Hydroecia*).

Phleum pratense : *Apamea gemina.*
Trifolium pratense and *T. dubium* : *Agrotis corticea.*

Those on roots of weeds were chiefly Noctuids (*Leucania, Apamea, Triphaena, Agrotis, Xilophasia, Mamestra*).

In breeding the various insects found in the soil, a number of parasites were reared ; the following are from new hosts : *Homocidus dimidiatus* Schr. and *H. tarsatorius* Panz. (Ichneumonidae, Tryphoninae) from pupae of *Platychirus albimanus* F. (the host being useful in the larval state in destroying *Pterocallis tiliae*, the aphis of lime trees) ; *Phaeogenes* sp. (Ichneumonidae, Ichneumoninae) from pupae of *Chrysopa vulgaris* L. (also useful in destroying lime aphis).

In the second part of his article the writer mentions that to most soil insects clay is unfavourable, as it hinders their movements ; this is particularly the case with active larvae like those of the predaceous Carabidae and Staphylinidae, while wireworms and leather-jackets seem to thrive in heavy clays. The question of aeration is of importance in this connection : most insects remain near the surface (out of the 140 species found in the field hardly 20 occurred at depths below 6 inches), but the larvae of *Hepialus humuli* burrow down as deep as 18 inches to pupate.

Stagnant water destroys the majority of insects ; an exception is provided by the larvae of *Agriotes lineatus* (wireworm), which in the writer's experiments were alive after immersion in water for six days, though nearly all were dead after eight days.

Many insects burrow deep into the soil during cold weather ; but others remain dormant near the surface ; larvae of *Triphaena pronuba* and *Agrotis segetum* and of certain Muscids found in frozen soil recovered indoors and eventually completed their metamorphoses.

The article is accompanied by a bibliography referring to a large number of works.

293 – **A List of Uganda Coccidae and their Food-Plants.** — GOWDEY, C. C. in *Bulletin of Entomological Research*, Vol. IV, Part 3, pp. 247-249. London, November 1913.

The climate and the luxuriant vegetation of Uganda render it a particularly favourable country for the development of insect life. Insect growth and multiplication are therefore continuous throughout the year. This is especially true with regard to the Coccidae.

Many of the forty-nine species enumerated by the writer have been found upon cultivated plants :

Icerya sp.	Orange.
I. caudatum.	Crotons.
I. seychellarum Westw.	*Monodora myristica* and *Eranthemum bicolor.*
Dactylopius sp. nov.	Unknown shrub.
D. (*Pseudococcus*) *citri* Risso.	Coffee, orange and lemon and an unknown shrub.
Tachardia decorella Mash.	*Anona muricata.*
T. longisetosa Newst.	Bark-cloth tree (*Ficus Sycomorus*).
Pulvinaria sp. nov..	*Tecoma stans.*
P. jacksoni Newst. (Parasitized by *Tetrastichus gowdeyi* Crawf.).	Cotton.

P. psidii Mask.	Coffee, *Funtumia elastica*, guava, tea, *Alternanthera versicolor* and *Markhamia platycalyx*.
Ceroplastes sp.	Guava.
Ceroplastes sp. nov. (two).	Bark-cloth tree.
C. africanus Green.	*Acacia* sp. and *Cajanus indicus*.
C. ceriferus And.	*Antignon leptopus*, orange, coffee, *Funtumia latifolia*, tea, canna, croton, Agave, Hibiscus and bark-cloth tree.
C. coniformis Newst.	*Ficus* sp.
C. destructor Newst.	Guava.
C. ficus Newst.	Bark-cloth tree.
C. galeatus Newst.	Coffee and bark-cloth tree.
C. quadrilineatus Newst.	*Anona muricata* and Nsambyia (*Markhamia platycalyx*).
C. singularis Newst.	Guava.
C. ugandae Newst.	*Acacia* sp. and *Anona muricata*.
C. vinsonioides Newst.	*Baikea eminii*, coffee and guava.
Inglisia conchiformis Newst. (parasisized by *Eublemma scitula* Ramb.).	*Anona muricata* and *Harrogania madagascariensis*.
Ceroplastodes gowdeyi Newst.	Bark-cloth tree.
Lecanium africanum Newst.	Coffee.
L. elongatum Sign.	*Albizzia* sp. and *Cajanus indicus*.
L. (*Eulecanium*) *filamentosum* Newst.	Unknown forest shrub.
L. (*Eulecanium*) *somereni* Newst.	Mulberry, *Tecoma stans*, and *Markhamia platycalyx*.
L. (*Coccus*) *hesperidum* L.	Orange.
L. (*Saissetia*) *nigrum* Nietner.	*Ficus* sp. and *Anona muricata*.
L. (*Saissetia*) *oleae* Bern.	*Chlorophora excelsa*.
L. tenuivalvatum Newst.	Elephant grass and lemon grass.
L. viride Green (preyed on by *Chilocorus discoideus* and *C. punctata*).	Coffee and guava.
Stictococcus dimorphus Newst. (parasitized by *Eublemma costimacula* Saalm.).	*Cajanus indicus*, cacao, *Croton tiglium*, *Anona muricata*, *Markhamia platycalyx* and mulberry.
S. gowdeyi Newst.	*Harrogania madagascariensis* and coffee.
Chionaspis cassiae Newst.	*Cassia floribunda*.
C. dentilobis Newst.	Palms and *Sapium mannianum*.
C. substriata Newst.	Palms.
Diaspis (*Aulacaspis*) *chionaspis* Green.	*Sapium mannianum* and *Cassia floribunda*.
D. regularis Newst.	*Chlorophora excelsa*.
Aspidiotus cyanophylli Sign.	Guava, palms.
A. cydoniae Comst.	Guava.
A. gowdeyi Newst.	*Anona muricata*.
A. transparens Green.	Tea.
A. trilobiformis Green.	Oleander.
Lepidosaphes beckii Newm. (*citricola* Pack).	Orange, lemon.
Ischnaspis filiformis Dougl.	Palms and bamboo.
Gymnaspis africana Newst.	Unknown forest shrub.

MEANS OF PREVENTION AND CONTROL

294 – ***Diaretus (Aphidius) obsoletus* n. sp., a Braconid Parasitic upon the Aphides *Brachycolus noxius* and *Toxoptera graminum*, injurious to Cereals in Russia.** — KURDJUMOV, N. in *Revue Russe d'Entomologie*, 1913, Vol. XIII, No. 1, pp. 25-26, 1 fig. St. Petersburg, 1913.

A systematic description of this new Braconid (Hymenoptera), which has been studied at the Experimental Station of Poltava and is regarded by the writer as an important parasite of *Brachycolus noxius* Mordwilko and of *Toxoptera graminum* Rondani.

In Europe *D. obsoletus* takes the place of the American parasite of *Toxoptera, Lysiphlebus tritici* Ash. ; it is near *Aphidius dauci* Marshall, from which it differs in certain morphological characters. Most probably, the parasite in question is a species confined to Southern Europe.

INSECTS INJURIOUS TO VARIOUS CROPS.

295 – **Insects and Mites Injurious to Cultivated Plants in France.** — NOEL, PAUL in *Bulletin trimestriel du Laboratoire d'Entomologie Agricole de la Seine Inférieure*, First Quarter 1914 (January-February-March), pp. 3-11. Rouen, 1914.

About 286 species of plants are cultivated in France ; amongst these may be enumerated 16 kinds of fruit trees, 28 horticultural plants, 31 forage and cereal plants, 14 forest trees, 32 ornamental trees and shrubs, 84 ornamental plants and 91 medicinal plants. Each of these species has several enemies amongst insects and mites ; the number of these enemies amounts to 1078 for oak, while for 25 other plants it reaches over a hundred.

The writer, who has studied agricultural entomology for forty years, has drawn up from the results of his own observations, and from data given in various works which have appeared in France from 1860 until the present day, some statistical tables for each of the seven categories of plants mentioned above. These show that the 286 kinds of plants which are cultivated in that country are attacked by as many as 12008 insects (Coleoptera, Orthoptera, Hemiptera, Neuroptera, Hymenoptera, Lepidoptera, Diptera) and mites, the numbers being divided as follows :

		No. of injurious insects or mites.
16	fruit trees	1 071
28	horticultural plants	704
31	forage and cereal plants	988
14	forest trees	4 637
32	ornamental shrubs and trees	1 109
84	ornamental plants	1 029
81	medicinal plants	1 870
Total 286	cultivated plants	12 008

296 – **The Life-History of *Aphis euonymi*, Injurious to Sugar Beets** (1). — GAUMONT, L. in *Comptes-Rendus hebdomadaires des Séances de l'Académie des Sciences*, 1913, 2nd Half-year, Vol. 157, No. 22, pp. 1092-1094. Paris, 1913.

The writer, having found *Aphis euonymi* to be very abundant on the beets growing in the neighbourhood of Montargis (Loiret, France), set himself the task in 1912 and 1913 of verifying the results of the investigations made in Russia in 1909 by Mordwilko, and determining whether this aphis passes the winter only in the egg condition, and solely upon *Euonymus europaeus* and *Viburnum Opulus*, or whether it possesses some other method of hibernating.

In the Orleans public gardens the writer observed in 1912 and 1913 that *A. euonymi* was often very abundant on *Euonymus japonicus*.

(1) See also No. 395, *B.* July 1913. (*Ed.*).

In order to protect the beets, it would therefore not be sufficient, as has been maintained, to destroy *E. europaeus* and *V. Opulus*, but it would be necessary also to sacrifice *E. japonicus*, which is a very common shrub in public parks and gardens.

Further, according to the writer, this measure would not be all that is required, for at the end of October 1913, he observed beets still attacked by the aphis at St. Germain des Prés (Loiret). On the lower surface of the leaves were found wingless and winged parthenogenetic individuals, as well as sexual ones. The writer was able to collect a certain number of paired insects and oviparous females in the act of depositing their eggs at the base of the stems of the beets. When the latter are harvested the neck is left almost entire, or the leaves are stripped off, if they are used as forage ; then the beets are stored in silos or cellars. The eggs can thus remain upon the neck, and hatch out in the silos or cellars ; the aphids then find their way out through the ventilating apertures, spread in spring to *Rumex*, *Chenopodium* or other wild plants, and thus form centres of infection. If these beets are used for seed, the insects can easily found a new colony upon the plant on which they were hatched. On the other hand, young beets which are too small to be taken are often left in the ground ; these resist mild winters, and if they contain eggs, can easily in the spring become centres of infection.

297 – ***Aleurodes vaporiarum*, a Parasite of *Azalea indica* in Belgium** (1). — VAN HOVE in *Revue de l'Horticulture Belge et Etrangère*, Vol. XXXIX (Vol. IX, 4th Series), No. 24, pp. 392-393. Ghent, 1913.

This insect, which is well known to Belgian azalea growers under the name of " mouche blanche ", was very abundant in the autumn of 1913. According to the writer, it is necessary to have recourse to every method of destroying this pest, if the prohibition of the export of *Azalea indica* is to be avoided.

After having given some information regarding the life-history and habits of this parasite, and of the damage caused by it, the writer enumerrates the preventive and curative measures to be adopted :

1) Fumigation with tobacco in the greenhouse; 2) spreading naphthalene upon heated plates in the greenhouse; 3) watering of azaleas planted out in the open with a mixture of soft soap, naphthalene, petroleum and tobacco juice ; 4) immersing the plants in a bath of lime water and insecticide ; 5) immersing the plants in a solution of soft soap and insecticide in the following proportions : 18 oz. soft soap, ½ oz. insecticide powder, and 3 ¼ gallons of water ; 6) the specialities recommended by the trade may be taken into serious consideration.

ALFREDO RUGGERI, *gerente responsabile.*

FIRST PART.

ORIGINAL ARTICLES

Present State of Plant Breeding in Denmark

by

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Superintendent of Experiments, Abed, pr. Søllested.

The improvement of agricultural plants in Denmark is a recent departure. In reality it is only at the beginning of this century that real progress in this direction has been made and a definite plan has been followed. Before this time the only really successful work was that carried out by ERHARD FREDERIKSEN, who, under the influence of the work and progress achieved in Germany, introduced similar operations into this country. Frederiksen employed also the methods adopted by the best German breeders of that period : Beseler, Bestehorn, and Rimpau.

The best known varieties that he bred were the following :

Forage sugar beets, a cross between sugar beets and mangolds ; *hybrid barleys*, crosses between Imperial (*erectum*) and Chevalier (*mutans*), and lastly *Normal Squarehead wheat*. The latter was produced by ear selection from the older Scotch Squarehead introduced in 1874, which, in the course of years, inclined to degenerate. The method adopted was the one usual in other countries : Ear selection of the best types and breeding mixtures of the same. At present the above varieties are not much grown. The Normal Squarehead attained considerable importance, not only in Denmark but also in Sweden and Germany, where it served as a basis for the further work of improvement undertaken by Strube and Heine.

In considering present work and its results, it appears advisable to take each group of plants by itself.

Root crops. — Without considering sugar beets, which have not been subjected to improvement in Denmark, and the seeds of which are not produced in the country, the various kinds of mangolds have been the subject of energetic efforts at improvement by the many private seedsmen of the country.

Among mangolds, the Barres mangolds, of French origin, have been most successfully improved as to uniformity, yield and production of dry matter. The method adopted, which, with the exception of slight modifications according to the species, is the same for all root crops, may be briefly described as follows:

The selection of the seed mangolds is made from the common stock. The finest mangolds are selected in large numbers and, with the object of provisional selection, often submitted to a direct test as to specific gravity, using a solution of salt of suitable strength. The heaviest mangolds are selected and with each of them the specific gravity of the juice is determined by means of an areometer. Some of the best breeders proceed further to the direct determination of the dry matter of the individual mangolds in samples bored out of the roots, and then set aside separately the most promising specimens. These are then enclosed, either singly or in pairs, in linen cloth bags until the flowering time is over. The seeds of the individual mangolds are sown in one or more small plots. The process is repeated with the offspring of the best lines.

Among the mangolds thus improved, those that deserve to be mentioned as the best are the Sludstrup, Rosted and Taaröje varieties, which have proved in the course of extensive experiments instituted by the State to be far superior to all foreign varieties in the production of dry matter per unit area. Similar results have been obtained with kohlrabi, turnips and carrots.

The exhaustive experiments carried out in the State Experiment Stations with the object of determining the value of the various root crops are placed under the management of L. HELWEG, of Copenhagen, director of the experiments. These experiments are of decisive importance both for the improvers and for the farmers, who would otherwise be seriously embarassed in the choice of the variety to grow. If the experiments were not conducted as they are, advertisements would be the only guide, while these experiments provide a decisive and impartial verdict on the results of the work of improvement. At intervals of a few years the results obtained in the State experiments are published in the "Tidsskrift før Landbrugets Planteavl" (Journal of Agricultural Plant Breeding), which appears in four parts every year, and discusses all the results of the experimental work of the State in Denmark.

Cereals. — As has been said above, but little was accomplished in this field previous to the year 1899-1900. At any rate, with the exception of Erhard Frederiksen's work, the results of practical importance have been obtained after that date. The work then began to proceed much more rapidly, partly owing to the new and more promising principles of plant improvement. Especially the discovery of breeding in lines attracted more breeders into the field. The first results of Svalöf in Sweden and the work of the Danish Professor JOHANNSEN, which proved that the type remained unchanged generation after generation in the individual lines of autogamous plants, contributed to awaken hopes which in reality did not lead to disappointment.

Up to the year 1899-1900 almost all breeders practised mass selection, that is selection of promising individuals or ears followed by breeding mixtures of this so-called " Elite ". The demand for this Elite was gradually raised, but on the whole the practical results were not great, and often even negative. Attention was continually directed too much to the *individuals* instead of to their *offspring*. It happened and still happens that the largest and apparently strongest plants by no means give the best offspring ; on the contrary the more modest-looking plants often produce the best progeny. In this connexion there could be no clear understanding so long as the *importance of heredity was not duly recognized*. In a mixture the more modest forms are often — literally as well as metaphorically — overshadowed by the finest individuals ; the latter however, in pure cultures, prove often inferior to the pure cultures of the progeny of less handsome individuals.

For a long time after the cultivation of the offspring of single individuals had been begun, it was rather difficult to understand the matter fully, notwithstanding the fact that striking proofs could be afforded that it was the right method to pursue. A critical examination of those varieties which, in the course of years, had been tried and then abandoned in favour of more productive ones, showed that as a rule the less good looking varieties were the best. The most esteemed about 1900 were: Squarehead wheat, Brattingborg rye, Danish (Provsti) oats and Prentice barley. All these varieties were, after the exhaustive experiments undertaken by P. Nielsen and, later, by the Malting Barley and Wheat Committee, recognised as the best for Danish conditions ; yet none of them could compete in appearance in the field, and on a rapid valuation of superficial conditions of growth, with a whole series of varieties which in reality were inferior in yield and quality. In one or more points the latter failed to meet the demands which are made in this country as to resistance to cold, strength of haulm, resistance to diseases of various kinds and yield of grain. The latter property depends upon so many factors that there are always but few varieties that possess the fortunate combination of all these privileges to any high degree.

About the year 1900 the following breeders were at work (partly on the above-mentioned lines of individual plants and their offspring): K. Hansen, Lyngby Experiment Station; K. Jørgensen, Lyngby ; N. P. Nielsen, Tystofte ; H. A. B. Vestergaard, Naesgaard (later Abed). The three latter worked almost exclusively with " pure lines ". The first results of these labours appeared in the years 1906-08 in a series of varieties of oats, barley and wheat (winter wheat). The following showed themselves, in numerous experiments, decidedly superior to the older varieties. Tystofte Prentice barley, Abed Prentice barley, Yellow-white Tystofte oats, Yellow Näsgaard oats, Tystofte Small wheat, Tystofte Stand-up wheat and Abed Large-eared wheat. The barleys are two-rowed and bent-eared. From six-rowed barley, Tystofte Hybrid barley has been bred.

Within the next few years several varieties will appear, among others Abed Binder barley.

At Lyngby some new varieties of winter barleys have lately been produced. In rye no novelties have been developed. The above-mentioned Brattinborg rye and the well-known German Petkus rye are generallly grown, and it will probably be some years before any new Danish-bred ryes appear.

The method adopted will be briefly described. The foundation is in all the above cases the individual plant. In its details the method varies: first the variety is selected from which a line is to be bred ; this is frequently one of the so-called country varieties, which includes several individual types. We can assume that a hundred such have been chosen; the next year fifty grains from each are laid, grain by grain, in furrows or holes in parallel lines; the growing plants are observed and all their various properties which can be of importance in practice are described. Each line is harvested by itself ; the quantities of grain and of straw are examined, and the thirty most promising lines are used for experiments plots on a small scale in the following year. The plots are two, each of 4 or 5 square yards in extent. In this year also the young plants are carefully observed in the field ; those with the weakest straw, as well as those inclined to disease, are eliminated. Only the eight or ten that yield the best results are kept for further experiments. The experiment in the third year are more comprehensive and are undertaken in a way to ensure greater reliance upon the results, for three or four parallel experiments are made on plots measuring 12 or 24 square yards. If all conditions have been favourable, the result of this experiment can be used for the further elimination of the least valuable novelties, and only two or three varieties are kept. The experiment is continued in the fourth year as in the third, and if no untoward circumstance arises according to the result of this year, in the fifth year the multiplication of the most productive variety on a large scale in the fields can be contemplated. But it seldom happens that one can foresee with sufficient certainty that the selected variety is really so much better than the best hitherto known, and in order to ascertain this, still a few more years must be devoted to experiments. For this experiment a good opportunity is offered by the two years which are generally required to bring the small quantity from the experiment plot to saleable quantities. In Denmark the State contributes also to the final decision of the question whether the new variety deserves to be put into general use or not, inasmuch as every variety of importance is tried in the Experiment Stations.

There is, besides, the local travelling experimental work conducted by the individual agricultural organizations. The experiments are undertaken by farmers under its supervision, so that the varieties are brought under varying conditions, and in every case they are compared with the best varieties of the same kind known at the time. When a new variety has satisfactorily stood these tests, as a rule it soon gets the rapid diffusion that it deserves, since the farmers are often acquainted with the results of the experiments before the variety is put upon the market. The offers of sale are made either by the State or by the agricultural organizations.

In the Experiment Stations where many varieties are compared, o

to 8 plots are used for every variety. In local experiments with only two or three varieties 10 or 12 plots are used so as to ensure reliable results.

The publication of the results of the travelling experiments is made once a year in the written (and verbal) reports of the Agricultural Federations in each of the four parts of the country : Jutland, Fünen, Seeland and Lolland-Falster.

The reports of the State Experiment Stations appear at longer intervals, embracing from 4 to 8 years. The results are thus based on the experiments of several years. Thus the two kinds of experimental work complete each other, in this as in many other fields, for the solution of the various questions.

The Chairman of the State Plant Breeding Committee is Professor T. WESTERMANN of Copenhagen.

Some of the recent results obtained in the State Experiment Stations with varieties and breeds of agricultural plants are mentioned below, as they present a more than local interest.

Experiments were made with *wheats* at Tystofte and Abed from 1907 to 1912. The greatest yields were given throughout by Wilhelmina Small wheat, Stand-up wheat and Large-eared wheat, which yielded from 58 to 67 bushels per acre. The three latter are Danish varieties of recent origin ; all of them, but especially the Stand-up wheat, are more resistant to cold than Wilhelmina. Altogether 20 varieties were tested, including 4 from Svalöf, 2 from Germany (Strube's Stockweizen No. 56 and Strube's Squarehead) and 2 from England (Stand-up and Original Squarehead). The worst yielding varieties gave, under the same conditions as the above-mentioned ones, 35 to 49 bushels per acre.

With *oats*, experiments have been conducted during a small number of years at six Experiment Stations. Out of 15 varieties tested, the following yielded the best results, with 84 to 87 bushels (of 42 lbs.) per acre : Yellow Näsgaard, Stern, Schlanstedt and Yellow-white Tystofte. The two first gave the best results on both loamy and sandy soil. Among the less productive were the following well-known varieties : Ligowo, Goldregen and Leutewitz. With the exception of Schlanstedt, the first group are all of Danish origin. The varieties that yielded least gave 8 to 12 bushels per acre less than the best.

Before the new varieties appeared, a great number of foreign varieties were tested, but all of them, with the exception of Schlanstedt and American Banner oats, yielded light crops.

With *barley* both the Agricultural Associations and the State Stations have conducted experiments for a series of years. The most productive varieties were Tystofte Prentice, Abed Prentice and Svalöf Princess. All these varieties sprang from the Prentice barley introduced in 1884, which, as was known later, was called Archer barley in its home (? Ireland). Of the other varieties grown, the following are to be mentioned : Svalöf Hannchen, Hanna, Goldthorpe, Imperial, Juwel, Stand-well, Chevalier. None of these, however, could compete throughout with pure-bred Prentice forms. The chief defects of Prentice barley are that it ripens late and

that the strength of the straw leaves something to the desired. Of late years all efforts have been directed towards producing an earlier variety with stronger straw.

Abed Binder barley appears, anyhow, to possess these last two requisites, but has not yet been tested enough under various conditions as to its productiveness. The variety is therefore not yet sent out for practical purposes.

Grasses and clovers. — Work with these, as with cereals, is comparatively recent and the nature of the work is such that it takes longer to reach decisive results with these plants than with the annual cereals. There is also the circumstance that most of them are allogamous, which renders constancy more difficult or impossible to attain.

The Experiment Station at Tystofte, whose Director is E. LINDHARD, deals especially with the improvement of these plants. A new improved ryegrass has been sent out this year from Tystofte. At Lyngby and Abed also, work is conducted on some kinds of forage plants.

The work at Tystofte is very extensive, especial attention being paid to isolating the individual forms, as well as to reliable control with the parent form in order to obtain the greatest possible constancy. Many hundreds of plants are enclosed in bags and harvested separately. The multiplication of elite plants is practised on a large scale. In order to ensure the pollination of red clover, nests of humble bees are enclosed with the clover elite in large linen tents. In this direction a great deal of work is done, but it will require five or six years more before judgment can be pronounced on the results.

The Cultivation of Sugar Cane in the Argentine Republic

by

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Historical notice. — Among the industrial plants grown in the Argentine Republic only two have acquired much importance : the vine and the sugar cane.

The latter was introduced into America by the Spaniards shortly after the conquest, and it spread immediately into the West Indies, Central America, Peru, Brazil and the northern part of Argentina. The first trustworthy evidence of the cultivation of sugar cane in this country dates back to the beginning of the seventeenth century and refers, as it appears from the archives, to a plantation which existed in the district of Chicligasta, province of Tucuman. However, before the Jesuits established themselves in this province in 1670 and founded a convent which still exists at Sules, no one had manufactured sugar in the country and the canes were only used for sucking.

In 1767 the Jesuits were expelled from Argentina, the manufacture of sugar ceased and the cultivation of sugar cane was kept up only on very limited areas. Up to the middle of the nineteenth century all the sugar consumed in the Argentine Republic came from abroad. For 54 years after the expulsion of the Jesuits, no one, as far as is known, made sugar, no doubt because no one was acquainted with the industrial treatment of the cane. In 1821 Dr. José Eusebio Colombres, a Tucuman priest who also played an important part in the political organization of the Republic, made a successful attempt to restart the sugar cane industry. At first only molasses were made. The results obtained by Dr. Colombres induced others to follow his example, and gradually rudimentary factories sprang up, at first satisfying the demands of the Tucuman market and later those of the neighbouring provinces.

It will easily be understood that as Tucuman is upwards of 600 miles from the nearest port, the first factories were very primitive, and that the sugar they produced did not reach the distant coast district, which at that time was the most populated and almost the only one having a civilized population that consumed sugar. In 1834, notwithstanding the short time that had elapsed since Dr. Colombres' initiative, the local Government dared to impose a tax of one peso per arroba (about 2 pence per lb). A few years later 24 small factories were at work. In 1860, without any other means of transporting heavy modern machinery than the traditional Tucuman bullock-cart, a bold attempt at improvement was made, which proved economically disastrous to its originator, Balthasar Aguirre, but must be mentioned because it had an influence on the subsequent improvement of the sugar industry.

Area under sugar cane. — The national statistics of 1911 return the area under sugar cane in the whole Republic at 230 770 acres, of which 210 000 are in the province of Tucuman ; it must not be forgotten, howewer, that Argentine statistics cannot be very exact, as the country is not yet fully organized and of enormous extent, and its institutions are still, in some respects, rudimentary. The general statistics to the end of 1913 are not yet published. The provincial statistics recently completed show that the province of Tucuman alone had on January 1, 1913, 220 000 acres under sugar cane.

As the cane plantations in the other provinces and territories extend very slowly, the acreage grown to canes in the whole Republic may be safely estimated at 250 000 acres.

The above data on the cultivation and on the utilization of the sugar cane refer almost exclusively to the province of Tucuman, which, as it is a very important economic and social centre, is destined to keep for many years its present supremacy in this industry, notwithstanding the existenc of other districts in Argentina equally and perhaps even more suitable for this crop.

Soil. — As sugar cane is grown over a wide area it occupies soils of different kinds ; they may be divided into two groups:

a) Loams, which contain up to 90 per cent. of clay, most of it being very fine. In general, growing sugar cane on such soils is not possible without the aid of irrigation.

b) Humous sands which have been recently cleared of forests and are situated on the slopes of forest-clad mountains, and where the cane can be grown without irrigation, as the soil is fairly moist, especially where it has been under cultivation for only a few years.

The chemical composition of most of the soils does not vary much : there is scarcity of lime, which rarely reaches 1 per cent., and an abundance of potash, of which these soils contain from 4 to 6 per 1000 ; they have a normal quantity of phosphoric acid, that is upwards of 1 per 1000, and of nitrogen, also about 1 per 1000.

Owing to the relatively recent introduction of this plant, to the depth of the arable layer and to economical reasons, the use of artificials has not yet become general.

Climate. — In the district of the province of Tucuman in which sugar cane is grown, and which lies between the parallels of 26° and 28° S, the climate is subtropical, but tempered by the vicinity of the high range of Aconquija on the west. These mountains are at the same time the principal cause of the rain which benefits local agriculture, rendering Tucuman a region of abundant moisture surrounded by completely arid belts in which no rain falls.

Meteorological observations carried on for many years exist only for the city of Tucuman, to which the data here given refer. They are therefore not strictly accurate for all the sugar cane area. The average rainfall of the last decade was 965 mm. (37.98 inches); the maximum during this period was 1308.3 mm. (51.51 in.), the minimum 739 mm. (29.09 in.). At the foot of the mountains, where most of the non-irrigated cane-fields are situated, the rainfall is considerably higher than the above average. The average mean temperature of 45 years is 19.28° C. (66.7° F.), the average highest 44.4° C. (112° F.), the average lowest 3.2° C. (37.8° F.). In the last decade 90 temperature readings were below 0° C. (32° F.) in the months of June to August, chiefly in June; and 6 readings above 40° C. (104° F.) in November, December and February. The influence of the wind on the temperature is great ; south-easterly winds lower it by 1.9° C. (3.4° F.), northerly winds by 2.4° C. (4.3° F.); southerly winds raise the temperature by 1.8° C. (3.2° F.), while those from the west lower it by the same amount. The winds are moderate and not frequent, and therefore do not cause lodging of the canes.

Varieties. — The greater portion of the area is under two varieties of cane which were introduced many years ago : the brown *Morada* variety, which is the prevailing one, and the striped or *Rayada*, next in importance. Both are considered local varieties (*criollas*), because they have acquired special characters which do not allow the original variety from which they are derived to be recognized.

For some years past attention has been turned to the cultivation of varieties introduced from other countries. The initiative of these experiments, at present in full swing, belongs to the " Escuela Nacional de Agricul-

tura y Sacarotécnia " of Tucuman, which in 1907 introduced 70 varieties. At present this institute possesses a collection of upwards of 250 groups of varieties, many of which have been studied from a technical point of view during the last few years. Though at present insufficient experience has been gained in this connection, it may be affirmed that the research hitherto carried out leads to the belief that, as in other countries, it will soon be found advantageous to replace to a great extent, if not totally, the varieties hitherto grown by some of those recently tly introduced. It is beyond discussion that the initiative of the Escuela de Agricultura y Sacarotécnia has raised much interest among the planters, many of whom have already provided themselves with the new seeds in order to test them, and thus cooperate efficiently with the official work.

The cultivation of sugar cane in the Argentine Republic will soon cease to be based only on colonial practice and tradition, and will be founded, as it is in other countries, on a scientific basis which will ensure an increased and an improved production of sugar.

As it is not possible to set forth in detail all the experiments that have been hitherto carried out, we shall limit ourselves to a summary of the experiments conducted in 1913 on some varieties of cane at the Agricultural Station attached to the Escuela Nacional de Agricultura y Sacarotécnia.

Form and duration of the plantations. — In the Argentine cane fields only one system of planting is followed : in the bottom of the furrow 8 or 10 inches deep the cane cuttings, each with three or four eyes, are placed in a continuous series. The rows are 6ft to 6ft. 8 in. apart The plantation is renewed every 6 or 7 years according to the quality of the soil. There are, however, plantations in which the canes are harvested without interruption for 10,12 and even 15 years. The first year after planting, the canes always give a crop inferior in quality and in quantity to that obtained from the canes originating from ratoons, the explanation being the shorter period of vegetation of the former. Plantations made in September or October are cropped in June or July of the following year, that is at 9 or 10 months old.

Irrigation. — Barely one-third of the acreage under canes in Tucuman is artificially irrigated. Owing to the abundance of rain from October to April, the canes, even without irrigation, yield remunerative crops under existing economic conditions. It is undeniable that in many cases the yield could be increased by means of irrigation, but for this it would be necessary to carry out important irrigation works, some of which have been planned during recent years. But even in the localities where irrigation water is available it is quite exceptional to find estates which irrigate systematically and drain in a suitable manner ; thus it is not rare to find irrigation more injurious than benefical. The time in which irrigation is practised is from October to February.

The work of cultivating does not last more than 6 or 7 months. The law on irrigation at present in vigour allows 25.7 cub. feet of water per acre per hour permanently, without taking into consideration the class of

crop. But only rarely is this quantity actually obtained, as the canals do not convey the necessary supplies.

Form of agricultural agreement for the cultivation of sugar cane. — In Argentina the sugar cane is grown under three forms of labour contract : 1) the plantations are managed directly by the owner himself or by an agent with the help of hired labour ; 2) they are worked on the share system by a "contratista" ; 3) they are rented. The first is the least frequent, as there are but few large proprietors who reside on their estates and manage them personally. This form, however, yields the largest profits, one acre of cane plantation yielding as much as £7 to £10 per annum.

The contratista gets by contract a certain number of rows of canes each 330 feet long; the sugar factory or the owner of the plantation supplies him, at a rate of interest agreed upon, with the necessary funds for all the farming operations, and at harvest time purchases the canes from him at a price which has been previously agreed upon between the parties, or which is fixed from year to year upon the basis of the current prices of sugar. The usual price is from 12*s* 3*d* to 14*s* per ton of cane delivered at the sugar factory ; assuming the produce to be about 10 tons per acre, which is an average yield, the grower gets £1 15*s* to £2 10*s* per acre net profit. Of course in bad years his profits are much less. This is the most common agreement, and usually lasts 2 to 5 years.

Farmers who rent the land are very few ; the rent is 4*s* 3*d* to 5*s* 8*d* per acre. The tenant plants and grows the canes on his own account, but almost always has a contract for the sale of the canes to a factory at a price proportional to that of the sugar.

Yield. — The old farmers of the province of Tucuman, who have grown cane for the last 20 or 30 years, maintain that the productivity of the striped and brown varieties has diminished considerably ; almost all attribute this falling off to the exhaustion of the land, which has always been put to canes without manures or rotation. Though our observations during four consecutive years do not allow us to determine completely the cause of the diminished yield, this decrease is evident in many localities, if not in all.

In the Experimental Station attached in 1913 to the Escuela Nacional de Agricultura, a series of soil analyses has been undertaken, beginning with those soils which have been longest under this crop, and continuing with those on which it has been introduced later. Although the data hitherto collected are not complete, they point already to the fact that the decrease of production is not only due to the exhaustion of the soil, but also and mainly to lack of care in the selection of the cuttings employed for replanting the cane fields, as well as to imperfect cultivation.

Until lately, owing to mistaken economy, it was the general custom in making a plantation to use the tops, that is just that part of the cane in which the eyes are least developed. It is true that in other countries the tops are used for this purpose, but they are countries with a more tropical climate, in which the vegetation of the canes lasts as much as 20 months, whilst in Tucuman the canes are for the most part harvested after 10 to 14 months.

Besides, as the time of planting coincides with the dry season, the tops have a more difficult start. If to this be added that in all kinds of soil only superficial ploughing is practised, reaching at most to 8 inches in depth, it will be readily understood that the yield has diminished even without the soil being exhausted. Some owners are trying deep ploughing by means of steam ploughs with success.

The average yields per acre are at present as follows :

	tons
Bad years	6 ½ to 8
Normal years	9 to 10 ½
Good years	11 to 14
Very good years	16 to 20

The cost of production of one ton of canes is from 8*s* 9*d* to 12*s* 6*d*. The sale price varies from 19*s* 6*d* to 25*s*.

Causes of injuries to the canes. — In some years the canes suffer considerably from unfavourable weather, but so far they have no serious pests to contend with. Among vegetable parasites there is only "polvillo" (*Bacillus sacchari*), which attacks the leaves and arrests the development and ripening of the canes. The parasite does not always appear with the same intensity ; it attacks all the varieties cultivated in the province, but not with the same frequency or gravity.

Among insects, the borer or "perforador" (*Diatraea saccharalis*) causes considerable injury in those years favourable to its multiplication. Other insects which are at present being studied are also injurious, but the mischief they do is not very important.

Progress of the industry. — There are at present 38 sugar factories in Argentina, 28 of them being in the province of Tucuman and the others in the provinces of Salta, Jujuy and Santa Fé and in the national territories of the Chaco and Formosa.

The sugar industry has progressed more rapidly than the cultivation of the canes.The old and modest factories of past years, equipped with wooden presses worked by hand or gins, have disappeared before the modern factories, almost all of which are provided with up-to-date machinery and worked according to the most approved methods. Of late years triple pressing with double saturation and the use of the Krajewski mill have become general. For the evaporation of the liquids, triple and quadruple concentration apparatus is commonly used, as well as recrystallizers and continued defecation.

Owing to the improvement of the factories, the yield of the canes rose from 3 per cent. in 1870 to 5 per cent. in 1881, and to the following figures taken from the official statistical returns :

	Variety	Weight of canes per acre — lbs	Average weight of a cane — lbs	Number of canes per ton	Length	
					Average — inches	Maximum — inches
4	Native Rayada	65 384	2.50	893	54	100
6	Native Morada	64 046	2.35	951	58	91
14	Poudre blanche	70 156	2.16	1 035	54	91
15	Roxa	57 757	2.13	1 049	52	85
18	Kavangire	94 362	1.39	1 604	69	104
19	Rayada from Brazil	47 900	1.55	1 445	50	79
26	Bois Rouge	55 482	2.04	1 093	46	87
36	D. Gaetano	68 327	3.86	573	71	108
46	Reine	57 712	2.10	1 066	47	87
48	Rose cayana	56 594	2.74	816	52	97
50	Green from the Antilles	53 921	2.40	931	55	98
55	Sin nombre 55	54 100	2.38	939	62	100
58	» » 58	59 095	2.20	1 014	58	93
62	» » 62	43 084	1.96	1 141	54	83
64	» » 64	71 583	3.48	643	65	104
74	Riscada de Santa Barbara	59 496	2.82	792	63	98
75	Manteiga de Santa Barbara	76 489	3.52	634	67	106
76	Java 234, ratoons	49 238	1.74	1 284	65	106
77	Sin nombre 77	114 622	1.32	1 691	69	108
79	Java 228, plant canes	64 090	2.10	1 066	57	91
	» ratoons	69 576	—	—	—	—
80	» 139 plant canes	48 123	1.58	1 418	60	93
	» ratoons	45 893	—	—	—	—
81	» 38 plant canes	81 350	2.45	912	72	104
	» ratoons	108 021	—	—	—	—
82	» 213 plant canes	56 241	1.58	1 411	47	93
	» ratoons	92 723	—	—	—	—
83	Barbara 228 plant canes	34 208	2.21	1 013	35	79

Diameter			Extraction	Analysis of juice					Saccharose extracted from 100 lbs of cane	Saccharose extracted per acre	Comparative value of cane	Classification according to comparative value
Average — inches	Maximum — inches	Minimum — inches		Brix %	Saccharose %	Purity	Reduction %	Reduction % saccharose	— lbs	— lbs		
1.30	1.93	0.63	65.1	16.44	14.08	85.6	0.31	2.2	9.152	5 984	61.2	11
1.20	1.81	0.55	62.8	17.61	15.42	87.5	0.21	1.3	9.684	6 202	64.8	9
1.16	1,54	0.75	63.0	17.10	14.38	84.1	0.64	4.4	9.059	6 356	63.8	10
1.19	1.54	0.79	61.4	16.22	13.58	83.7	0.53	3.9	8.338	4 816	48.1	20
0.79	1.14	0.43	60.3	16.68	13.60	81.5	0.28	2.0	8.241	8 024	78.1	5
1.03	1.42	0.67	61.2	14.63	11.35	77.6	0.28	2.4	6.945	3 327	30.8	28
1.20	1.58	0.83	62.3	16.67	14.18	85.0	0.35	2.4	8.834	4 902	49.8	19
1.38	1.81	0.87	67.9	17.39	14.80	85.1	0.55	3.7	10.049	6 866	69.8	7
1.23	1.58	0.79	61.5	16.63	14.41	86.5	0.30	2.1	8.662	5 115	53.0	16
1.36	1.85	0.79	64.0	16.10	14.15	87.8	0.30	2.1	9.055	5 125	53.7	14
1.22	1.58	0.87	63.3	16.30	13.70	84.0	0.40	2.9	8.672	4 676	46.2	21
1.19	1.65	0.67	64.7	17.05	14.93	87.5	0.31	2.1	9.660	5 226	54.6	12
1.16	1.77	0.71	63.5	16.83	14.31	85.0	0.36	2.5	9.087	5 370	54.5	13
1.13	1.65	0.43	60.0	17.81	15.54	87.2	0.23	1.4	9.324	4 017	41.8	26
1.30	1.81	0.63	65.5	18.25	15.79	86.5	0.47	2.9	10.279	7 564	78.2	4
1.28	1.94	0.59	61.6	16.51	14.18	85.9	0.28	1.9	8.735	5 197	53.3	15
1.35	1.73	0.87	66.0	15.39	11.62	75.5	0.92	7.9	7.669	5 866	52.9	17
0.94	1.22	0.63	55.6	18.12	16.11	88.8	0.08	0.5	8.957	4 410	46.8	22
0.79	1.30	0.43	57.3	17.28	14.44	83.5	0.27	1.8	8.274	9 484	94.6	3
1.10	1.46	0.79	64.5	15.95	12.95	81.2	0.36	2.8	8.353	5 354	51.9	18
—	—	—	60.5	18.81	16.01	85.1	—	—	9.686	6 739	68.5	8
0.99	1.30	0.59	57.0	18.35	15.13	82.4	0.34	2.2	8.624	4 385	43.2	24
—	—	—	57.9	19.55	16.19	82.8	—	—	9.374	4 302	42.5	25
1.07	1.30	0.59	61.1	16.87	14.21	84.2	—	—	8.682	7 062	71.5	6
—	—	—	58.8	18.85	15.76	83.5	—	—	9.267	10 010	100.0	1
1.04	1.30	0.63	61.3	15.58	13.25	85.0	0.15	1.1.	8.122	4 568	46.4	23
—	—	—	57.5	19.38	17.38	89.5	—	—	9.993	9 266	99.2	2
1.51	2.09	0.79	62.4	17.07	14.69	86.5	0.18	1.2	9.167	3 135	32.4	27

Years	%	Years	%
1903	7.56	1909	6.21
1904	8.07	1910	7.68
1905	7.49	1911	6.37
1906	6.14	1912	6.58
1907	6.52	1913 up to Oct. 31	8.03
1908	8.21		

In 1913 the most modern mills had an average yield above 9.5 per cent.

The further improvement of the methods of sugar-making will henceforward be assisted by the small sugar factory (capable of crushing 30 tons of canes per day) which, in June 1914, will begin to work at the Escuela Nacional de Agricultura y Sacarotécnia, and which is devoted to experiments, to objective teaching and to the instruction of capable experts.

Up to the present about £ 14 000 000 are invested in the sugar industry in the Argentine.

Foreign refined sugar pays at present a customs duty of $1^3/_4 d$ per lb., which according to the provisions of law No. 8877 of February 8, 1912, will be gradually lowered to 1 $\frac{1}{2}$ d per lb. in 1921.

At present only four sugar refineries exist in the Argentine; two of them are very important and others will soon be erected.

Recent Work of the Royal Hungarian Station of Biology and Animal Nutrition

by

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Of late years the Station has conducted research work of general interest connected mainly with the composition of the fodders produced in Hungary and their nutritive value, as well as upon animal metabolism, especially in pigs.

The Station has made exhaustive investigations into the problem of metabolism in these animals, on account of its theoretical and practical importance and also because it has been less studied than in cattle and horses. In order to reach reliable results, the metabolism in fasting pigs and the energy required for their maintenance must be known exactly.

With the aid of a respiratory apparatus, constructed for the purpose, the total quantity of water and of carbonic acid expired by the animal was determined; in the same way the animals under experiment could be observed at temperatures ranging from 5° C. to 30° C. The first research was to determine the minimum amount of energy required by the pig at rest and fasting. This amount depends in the first place upon the surrounding temperature and reaches its minimum at the so-called critical temperature,

at which the oxidation processes in the animal organism are at their lowest. Our experiments, made on two young pigs weighing 101.2 and 114.4 lbs., and two adult pigs weighing 250.8 and 279.4 lbs., have shown that, during fasting, the transformation of energy in the growing pig not fattened is lowest at a temperature of from 20° to 23° C. (68° to 73.4°F.), which is the critical temperature of the unfattened pig. In the fattening pig the critical temperature is probably lower, about 17° C. (62.6°F). The transformation of energy observed at the critical temperature is the minimum functional work of the pig, which, in the fattened animal (about 220 lbs.), is 8.91 calories per pound weight of the body and 98.5 calories per square foot of body-surface, while in the unfattened animal (about 110 lbs.) it is 12.36 calories per pound weight of the body and 102.2 calories per square foot of body surface. It follows that the minimum functional work calculated per unit of body-surface is independent of the fat in the animal.

Our recent experiments have the object of determining the requirements of energy in pigs.

We have recently experimented upon dried pomace, one of the fodders of the country. In Hungary the majority of distillers dry their pomace completely; only one distillery presses it before drying it, thus drying only its solid parts. We have compared these two kinds of pomace. Their composition varies very much, the variation being rendered more marked by the fact that the distilleries add carbonate of lime in varying quantities to the completely dry pomace. The pressed pomace contains less amides than the unpressed samples. In the latter the sum of fat and crude protein is generally between 39 and 44 per cent., and in the former between 44 and 60 per cent. The nutritive matters of pressed pomace are not so digestible as those of the entirely dried pomace, with the exception of protein, which is equally digestible in the two. The lower digestibility of pressed pomace is due to the elimination of the more digestible parts by pressing. It appears, by comparing the fresh and pressed pomace from the same source, that desiccation has no effect on the composition of the dry matter or on the properties of the fatty matter; on the other hand it diminishes considerably the digestibility of the crude and true protein. Dried pomace and, in a greater measure, fresh pomace caused a considerable fixing of nitrogen in cattle, that is to say they favoured the formation of flesh.

The experiments made with pomace assisted also in determining in what manner the dry and fresh material act on the production and composition of milk. Experiments made with two cows showed that the same quantity of dry matter fed either fresh or dry has the same effect on the quantity of milk, provided the requirements of the cows as to protein and energy be satisfied in both cases. When we fed fresh pomace in excess of the necessary food, only a very small part of the excess produced any noticeable effect on the animal organism and on the yield of milk. The substitution of dry pomace by fresh pomace containing the same quantity of dry matter did not in any way modify the content of dry matter and fat, or the specific gravity of the milk, or the index of refraction of the

milk serum. The substitution of fine wheat bran for dried pomace diminished the amount of milk yielded by the two cows under experiment. While the amount of fat in the milk of one cow did not change at all, in the other it increased a little.

The iodine number of the butter fat in the milk of the cow fed on wheat bran was lower than that of the one fed on dry or fresh maize pomace. After having been fed on fresh pomace, the iodine number of the butter fat was higher than when the animals consumed the same amount of dry matter under the form of pomace.

During recent years we have devoted much attention to maize for fodder, as this is one of the most important fodder plants of Hungary. It is generally sown in rows 6 to 8 inches apart; but for late sowing or in dry soils the distance between the rows is increased to 12 inches. This system is followed both for the maize to be fed green and for that to be ensilaged. For the latter, of late, distances of from 20 to 28 inches have been proposed.

In order to ascertain the influence of these distances between the rows on the yield and nutritive value of the fodder, we have determined the degree of digestibility, the yield of crude nutritive matter and the loss of weight caused by ensilage. The composition of maize sown close and wide varied considerably for a number of samples of green and ensilaged maize grown in both ways; the crude fat and protein content of the crop sown close was inferior to that of the other according to comparative feeding experiments on sheep; the digestibility of the maize after being ensilaged was the same in the two cases. The production of crude nutritive matter varies exclusively with climatic conditions, for after a normal amount of rainfall it is the closely sown maize that yields most, while after a dry summer the reverse is the case. Nevertheless this difference is not proportional to the greater expense of sowing maize in drills wide apart.

Considering: 1) that the later harvest of maize sown in drills wide apart delays ploughing operations considerably; 2) that it is more expensive than close sowing; 3) that it is only in dry years that the greater cost is balanced by the heavier yield, it may be concluded that wide sowing is only justified where drought is frequent.

Our Station has also determined the losses caused by the fermentation of other important fodder plants, such as lucerne, beets (tops and leaves) and the stalks of common maize. We have recently made similar experiments on mangolds, and then by experiments on pigs we have determined the percentage of nutritive digestible matter in fresh and in ensila ed mangolds.

The digestibility of ensilaged mangolds was somewhat inferior to that of the fresh mangolds. The coefficient of digestibility of the ash and of the crude protein showed great divergence. On the total organic matter preserved in the silo there was a loss of 13.1 per cent., and on the total digestible organic matter it was 14.6 per cent. The greater part of the absolute loss was in the carbohydrates, which make up the bulk of the organic matter of the mangolds, whilst it was the digestible protein which suffered

the greatest relative loss (30.93 per cent.). As, however, the protein content of mangolds is very low, this loss deos not diminish the favourable results of ensilaging. Besides, this result could be attributed not only to the quality of the mangolds but also to the duration of storage in the silo, which was 3 ½ months.

Considering that in Hungary the tops and leaves of beets are much used as food for cows, we have determined the digestibility of this forage both fresh and ensilaged, investigating also its influence on the production and composition of the milk. As the farmers who dispose of the tops and leaves of beets generally also get the pulp of the beets from the sugar factories we have compared these two fodders. These experiments, carried out on two farms, were made on 66 cows. They have demonstrated that feeding the same quantity of wilted tops and leaves and acid pulp instead of fresh pulp increased the milk yield and the live weight of the cows, while the specific gravity and butterfat of the milk did not undergo any variation. By feeding tops and leaves of beets in sour ensilage instead of an equal quantity of sweet pulp, the milk yield, the live weight of the cows, and the specific gravity and butterfat of the milk did not show any variation.

The chemical and physical properties of the butterfat produced by feeding wilted tops and leaves in sour ensilage did not differ at all from those of the butterfat of the milk obtained by feeding with beet pulp, which is important from the point of view of the manufacture of butter.

The milk of cows fed on beet pulp and tops and leaves, wilted or as sour ensilage, coagulated with the same rapidity and presented no difference in the composition of the curd, so that cheese of the same flavour and composition can be made from the two milks.

Experiments and Points of View in the Study of Animal Metabolism with the aid of the Respiratory Apparatus

by

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The scientific study of the nutrition of domestic animals was limited for a long time to the analyses of foods and to their comparison with the excretions, from which the material used in the body of the animal was inferred. Though the analyses of food, connected with the analysis of the solid excrements and of the urine, rendered possible the determination of the *digestibility* of foods and of the proportion of proteins retained by the body, and, in comparison with the simple analyses of foods, represented a considerable step forward, still simple practical observation showed that equal quantities of digestible foods by no means always

caused the same performance on the part of the animals, in the form of either work or human food (milk, meat, fat). On these conditions of uncertainty only the use of the respiratory apparatus could throw light, because it allowed the consumption and the retention of the nitrogen-free components of the food and of the animal body to be determined with the same precision as was formerly possible only for the nitrogen-containing substances by means of the analysis of the urine. The method of keeping account of animal metabolism by determinations made on excreta contemporaneously with those on the respiratory function, according to Pettenkofer's method, was first applied to the larger domestic animals by Growen, then in a considerably improved form by Henneberg and Stohmann; finally, it became so accurate in the hands of Gustav Kühn and especially of Kellner that it afforded the possibility of obtaining data on the effect of the most important foods in the animal body.

The simplest conditions are those offered by the Carnivora, in which the food contains very little inert matter, so that the greater part of it is digested and utilized in the body of the animal. Consequently it was with Carnivora that Bidder and Schmidt, Bischoff, Voit and Rubner were able to establish the first precise laws on the relation between the matter taken into the body and that retained by it. A schema of the processes involved, which, though not true under all conditions, is very suitable as a basis for further considerations, is afforded by the substitution, demonstrated by Rubner for certain cases, of the transformed component parts of the body and of the foods in proportion to their combustion heat. Rubner called isodynamic those quantities of different foods which have the same effect in the body in keeping up its composition, and found that such quantities of food as, on being burned, produced the same amount of heat proved isodynamic.

This view harmonizes with the experience which I had already acquired with Von Mering on the quantity of oxygen which animals take up with various foods. We found that the consumption of oxygen of an animal is not noticeably altered when foods which previously did not exist in large quantities in its body are introduced directly into the blood; this was shown with sugar, organic acids, certain soluble proteids, and the products of their splitting up. The amount of heat produced by combustion with a definite amount of oxygen is almost the same for all foods; for proteids and fats it is almost equal, while for carbohydrates it is about 5 per cent. higher. Consequently we also found that on supplying some of the latter, sugar for instance, the consumption of oxygen sank somewhat when the animal had previously performed its work, as is the case in a state of hunger, at the expense of the fat of its body. The reciprocal substitution of foods in relation to the heat produced in the body by their transformation appears most clearly in the case of muscular work. For a certain mechanical work the organism, as, in conjunction with several collaborators, I was able to prove by means of respiratory experiments, always requires the same energy expressed in

calories, and this independently of whether it be produced by transformation of carbohydrates, fat or protein.

The isodynamism of foodstuffs with those constituents of the body that are burned under conditions of hunger does not exist when the former are fed in greater quantities. An increase of consumption takes place, which is very probably caused by the active work of the alimentary canal, and its muscles and glands, as well as by the increased action of the heart, the kidneys and other organs, caused by elaborating the food. This view of considering the greater consumption after giving food as "work of digestion" is supported especially by the behaviour of herbivorous animals, which take a quantity of inert matter in their food. In the horse we were able to prove that an increase of the transformation much superior to that due to the digestible nutriment takes place under the action of the crude fibre of plant food, and to such a degree that every gram of crude fibre in the forage, which by its combustion would produce 4.2 calories, requires 2.6 of these for the increase of the transformation that it renders necessary, that is for the greater work of digesting. A considerable portion of this work of digestion we were able to attribute, in the horse, to the work of mastication, for during the mastication and swallowing of food rich in crude fibre an increase of consumption takes place; for hay this amounts to about 10 per cent. of the total combustion value of this food. Kellner has proved in the case of cattle fed with straw that the consumption is much diminished when the food is given finely ground or when it is freed from its encrusting matter by the process adopted in paper making.

For these investigations, as well as for those on the effect of working the animals upon metabolism, a method of carrying out respiratory experiments which Geppert and I have elaborated, and which differs considerably from Pettenkofer's, has proved the most suitable. We examined directly the air exhaled, either by a fistula in the wind-pipe or, in the case of men, by suitable masks which prevented all losses. This method (1) is superior to Pettenkofer's in that we could analyse with the same precision not only the carbonic acid given off, but also the consumption of oxygen, and measure exactly the combustion processes in the animal body for short periods, even for only a few minutes. We were thus able to ascertain precisely the effect of *every kind of muscular work* in man and in animals and also the effect which the *food exerts in the various stages of digestion.*

Not less important than the possibility afforded by our method of carrying out analyses during any short space of time, is the fact that we can ascertain at the same time and with equal precision, the consumption of oxygen and the production of carbonic acid. Only in this way is it possible to become acquainted with the nature of the foods transformed in the body, for foods differ in their ratio of oxygen consumption to carbon dioxide production during combustion. This ratio, the so-called respiratory quotient, is especially different in fats and carbohydrates. The volume of carbonic acid produced divided by the oxygen consumed

(1) Cf. accurate description by MAGNUS LEVI, *Pflügers Arch.*, 55, p. 1.

gives 0.7 for the former and 1.00 for the latter. When, in feeding, fat is formed out of carbohydrates, the quotient rises above 1.00 and can with intense feeding attain the value of 1.34 (Bleibtren, with geese fattened on oatmeal cakes). When the carbohydrates of the food undergo fermentative processes in the digestive tract, in which hydrogen and methane are given off, the quotient of the total exchange of gases can also rise considerably over the unit. In these cases the determination of the production of carbonic acid alone is not sufficient to give an approximately exact idea of the transformation of energy in the body.

During the last few years we have gained in several directions a deeper insight into the processes of metabolism by means of a combination of our method for measuring the direct respiration of the lungs with an investigation of the 24 hours respiration processes in the closed chamber, in harmony with Pettenkofer's principle. In these long continued experiments, also, the great value of the simultaneous determination of the consumption of oxygen and of the production of carbonic acid has been recognized. The investigation into the transformations taking place in the animal body deals essentially with three classes of foods: proteins, fats and carbohydrates, which also differ considerably in the quantities of carbonic acid given off in the production of equal amounts of heat. If, as in the older metabolism investigations, we determine only the production of nitrogen and carbon (as carbon dioxide), we are only capable of ascertaining how much nitrogenous material, *i. e.* protein, has been transformed and how much carbon has been formed from nitrogen-free material (fat+carbohydrate). But if we want to know how much of each of these foods has been transformed, and this is necessary if we want to calculate the quantity of energy developed in the body under the form of heat, we must determine a third factor which allows us to distinguish between these two classes of nitrogen-free foods. This third factor can be either oxygen or the quantity of heat produced by the animal; the two factors are about equally suitable. For, with an equal production of carbonic acid, fat produces about 24 per cent. more heat than carbohydrates and requires about 41 per cent. more oxygen. The choice of methods thus depends chiefly upon the relative facility and reliability of measuring the heat on the one hand, or the consumption of oxygen on the other. In the present state of technical knowledge, the determination of the oxygen, especially for short periods, is the more exact method. The best is to determine both factors, as has been practised by Benedict and his collaborators in recent experiments. In the generation of heat we have, then, a very valuable control of the results calculated from the production of nitrogen and carbonic acid and the absorption of oxygen.

The method developed by me for the determination of the consumption of oxygen in experiments lasting any length of time, is only an improvement on the respiratory apparatus used for small animals by Regnault and Reiset, before Pettenkofer.

The disadvantage of this apparatus was that the carbonic acid content in the air of the box was abnormally high, and that it was also permanently saturated with aqueous vapour, besides which the odorous emanations from the alimentary canal accumulated in it in increasing quantities. The way in which all these inconveniences have been avoided in my apparatus is described in detail in Vol. 44 of the *Landwirtschaftliche Jahrbücher*. I only mention that it is possible to determine with it the consumption of oxygen, the development of carbonic acid, and also, if desired, the evaporation of water from the animal body, with equal precision, and that during the whole time the air of the chamber can be kept dry and free from odours. In another direction also, which is especially important in research work on ruminants and on pigs, I was able to improve on Pettenkofer's method by providing greater precision for the determination of the combustible gases. Among these, methane is produced by ruminants in such quantities that it accounts for about 10 per cent. of all the carbon emitted under the form of gas, as was determined first in the experiments of Pettenkofer, and later confirmed by Kühn and Kellner. The method of Regnault-Reiset as used by us has the advantage that these gases remain entirely in the respiratory chamber up to the end of the experiment, and that therefore their percentage in the air to be analysed is much higher and can consequently be determined with greater precision. We succeeded also in estimating exactly the amount of hydrogen formed. This is often produced together with methane in the intestinal fermentations, and is important in some experiments, for instance in those after feeding large quantities of foods containing sugar. Up to one-fifth of the combustible gases consisted of the hitherto neglected hydrogen, and the proportion of this gas is still greater in the intestinal fermentations in pigs. Even a considerable accumulation of hydrogen and methane in the air of the respiratory chamber are of no consequence, as neither of the gases is poisonous and they have no more effect than the nitrogen of the atmosphere.

We have already mentioned that the nutritive value of a food is considerably modified by the amount of energy which is lost in its digestion and assimilation. It must be added that, with many foods, there are notable losses in the later transformations undergone in the body (specific dynamic effect according to Rubner), and that these losses play an important part with proteins. To these two causes of disagreement between the heat produced by combustion of the food and its nutritive value in the body, a third cause, especially active in ruminants, may be added, *viz.* the loss of energy through fermentation. Kellner attempted its determination and made allowances for it in his experiments by determining the combustible gases developed. It is, however, clear that the combustible gases make up only a part of the loss. We know that every fermentation which is a vital process of lower organisms is connected with the consumption of energy: we observe an instance of this consumption of energy in the heat given off in the fermentation of yeast. Such "fermentation heat", produced in the fermentations in the intestine, can only be of use to the animal in

those rare cases in which the heat produced by metabolism is not enough to cover its requirements. This happens with ruminants only when they find themselves in very cold surroundings in winter. Otherwise, the heat given off by fermentation processes, like that produced by fatiguing muscular work, must be got rid of by special work of the body, such as increased circulation of blood in the skin and secretion of perspiration, that is by consumption of energy.

From the above it is seen that the nutritive value of a food cannot be calculated simply from its content of digestible nutriment. From the quantity of energy that these digestible nutriments contain, the following have to be deducted : the work of digestion connected with their assimilation, the specific dynamical effect for their transformation into components of the body, and the losses by fermentation. From what has been previously said, it is evident that, among these factors, the work of digestion depends to an extraordinary degree upon the mechanical constitution of the food, upon its state of division, and upon its content of crude fibre. Similarly the loss by fermentation must be reckoned with, to a greater extent in ruminants, to a lesser one in other animals ; of this loss, hitherto we have only known a part, namely that represented by the combustible gases leaving the body, while the loss in fermentation heat has never yet been determined. As the fermentation processes vary considerably in extent in the various domestic animals, the utilization value of a food can only be given for a particular species of animal. Consequently the great number of determinations of the utilization value of foods, made by Kellner by means of Pettenkofer's respiratory apparatus, are true only for ruminants, or, to be still more precise, only for cattle, since in sheep it appears that the processes of fermentation are different. This fact must be borne in mind when using the "starch values" introduced by Kellner for convenience in calculating feeding rations. Under the term "starch value" of a food, he designates that quantity of a food which lays on as much fat as 1 kg. (2.2 lbs.) of starch.

In the horse, only a small proportion of the starch or of the starch-containing grain that is fed, ferments, while in cattle upwards of 10 per cent. of the heat of combustion of the digested food leaves the body unutilized as methane, besides which, another quantity of heat, which I provisionally estimate at about 70 per cent. of the heat of combustion of the methane, is lost as fermentation heat, while with fat no such loss occurs either in horses or in cattle. Consequently the ratio of the nutritive value of fat and starch is quite different in cattle and in horses. In pigs it is about the same as in horses. Thus if we apply to pigs or horses the same starch value for a fat food, such as an oil seed, as was determined by Kellner for cattle, we commit a notable error. But this is not the only uncertainty in these calculations. I may state that an important result of the investigations conducted of late years in my Institute has been to show that the same food may undergo very different losses by fermentation. According to the proportion in which a food is given, it ferments with greater or lesser intensity and suffers different losses. Of especial importance is the fact that

the fermentation of easily soluble sugars in the paunch of ruminants is from four to five times more rapid and intense than that of starch. Not less important is the fact that owing to the presence of such easily fermenting substances, the fermentation of cellulose, which is indispensable for the solution of the food, is considerably limited. Up to a certain point, the consequences of these irregularities in the fermentative processes have long been known. It is thus known that foods rich in sugar, especially beets, cause a so-called "depression of digestion", that is, that they notably diminish the solution of cellulose and consequently act unfavourably on the total utilization of the food. What hitherto was not known, but which appears evident from our experiments, is the fact that even small changes in the composition of a food can have a great influence on its utilization. In corroboration I shall mention some experiments on the nutritive value of potato distiller's slop compared with the raw material from which it was made.

In collaboration with Von der Heide and Klein, I have published a report of these experiments in *Landwirtschaftliche Jahrbücher*, Vol. 44, p. 765. In four series of experiments a supplement was added to a basal ration of hay fairly sufficient to cover the requirements of the animal; it consisted in the second period of 5.5 lbs. of dried potatoes with the quantity of malt and yeast necessary for its fermentation. In the third period the supplement consisted of the slop produced by the same quantity of potatoes plus the amount of starch which had been lost by fermentation. In the fourth period the same quantity of energy which had been fed in the two previous periods was fed exclusively in the form of slop. The supplement was nearly equivalent, in respect of its combustion heat, for it corresponded:

in the	2nd	period	to a	quantity of heat	equal to	92.53 calories
»	3rd	»	»	»	»	92.37 »
»	4th	»	»	»	»	91.73 »

The fat and flesh laid on by the animal corresponded in the three periods to the following percentages of the combustion heat of the supplements:

2nd	period.	47.8	per cent
3rd	»	33.78	»
4th	»	48.80	»

Of special significance is the comparison between the second and third periods, in which exactly the same food was given, except that in the third there were the modifications caused by the growth of the yeast and the formation of the bye-products of the transformation of starch into alcohol. The different effect of slop + starch mixture compared with the original material is shown almost more strikingly by the fact that in the second period 33 grams of protein were laid on daily by the animal, while in the third period 21 grams were lost, than by the combustion value of the material laid on.

The amount of fat laid on in the 2nd period was . . . . 446 grams
» » » 3rd » . . . . . 341 »

If these experimental results are calculated according to Kellner's principle of the starch values of foods, it would appear from experiment 4 that the 2428 grams of slop fed, since they caused the laying on of 4477 calories, acted as 1897 grams of starch, which gives 100 parts by weight of dry slop 78.13 parts of starch value. This figure is about twice as high as the starch value which Kellner attributes to potato slop, without, however, basing it upon direct experiment. In opposition to this extremely favourable nutritive value of slop in the case of exclusive feeding together with hay, it shows itself much inferior in combination with starch. For the 1984 grams of crude starch containing water correspond to 1570 grams of pure starch, while the total material laid on, 3120 calories, corresponds to 1322 grams of starch value. In this case, then, the added slop had a negative value in its nutritive effect. The explanation lies exclusively in the enormous losses by fermentation caused by the combination of slop and starch. That the difference of fermentation, as it appears in the above example, was not due to change, could be proved by a further series of experiments by Markoft in which the fermentative processes were examined directly in the contents of the paunch extracted by means of the oesophageal tube (cf. *Biochem. Zeitschrift*, Vol. 34, p. 210, and Vol. 57, p. 1). The technical part of these experiments is fully described in the latter volume. It led to the proof that the addition of easily soluble carbohydrates, or the addition of soluble proteins or of amides, on a stomach content poor in protein, increases the fermentation to a considerable extent. But not only is the intensity of fermentation, *i. e.* the quantity of methane produced, deeply modified by changes in the composition of the contents of the paunch, but also the kind of fermentation, and consequently the magnitude of the losses. During the experiments, not only the quantities of the gases developed (CH_4 and H_2) were determined, but also the quantities of volatile fatty acids formed as fermentation products, which represent the utilizable products of fermentation. It was seen that for equal quantities of combustible gases, and for equal quantities of transformed carbohydrates, the quantity of fatty acids produced was very different, and consequently that the utilizable portion of the fermented carbohydrate varies very much according to the quality of the fermentation. In many cases, the common fermentation in which mainly butyric acid and methane are formed, is replaced by one in which the chief product is lactic acid with insignificant quantities of combustible gases. In this case the utilization of the fermented food is considerably more favourable than when methane is developed in great quantities, but cellulose appears to take but little or no part in this kind of fermentation. The cell membranes not being sufficiently opened, it leads therefore to a greater depression of digestion, which in the end makes it appear less favourable to the animal than the usual methane fermentation.

Further it has been observed during the above-described fermentation experiments, that fermentation can be very different when ensilaged forage,

such as ensilaged beet leaves or potato haulms is fed. Consequently all existing data on the nutritive value of such ensilaged foods must be revised. As is well known, hitherto, with all such kinds of foods, the loss of carbohydrates has been calculated under all circumstances as an equally large loss of nutritive material, whereas this view is not justified, because the organic acids formed in the course of fermentation are directly available to the animals, while most, if not all, of the carbohydrates fed in the fresh fodder ferment in the paunch forming the same acids. From the above it is evident that many parts of the hitherto accepted theory of feeding require revision.

We must no longer attribute to a certain food the same nutritive value under all circumstances, as has hitherto been done. We must rather find out in what combination the nutritive value of a food proves the most advantageous. We must learn to avoid the causes which depress digestion and the loss of nutritious matter by excessive fermentation, and, on the other hand, to choose such combinations of foods that the least easily digestible portions of the food are utilized to the greatest possible extent.

Hitherto we have been able to carry out only a few experiments in this new field of research. A series of experiments published in the *Landwirtschaftliche Versuchsstation* (Vol. 79-80) should be mentioned here, as it shows that one and the same food has a very different effect according to the way in which the various components of the same are mixed together. A food consisting of hay, starch, rye meal and linseed cake caused a greater formation of fat, and consequently a higher utilization value, when all the hay and the linseed cake were given at one feed, and the starch-containing foods at the other. In this case the stimulating effect of the concentrated food rich in albumen favoured the fermentations and the dissolution of the crude fibre of the hay, while in the check series of experiments in which the starch was given together with the hay, the crude fibre of the latter was digested to a smaller extent, so that the final result, namely the laying on of fat, was much less.

On the same principle as these experiments, the results of which have been published, other series of experiments have been carried out with the object of showing how the utilization value of a food is influenced by its special mechanical constitution and by the way in which the various components are mixed and set to ferment together in the paunch. In this way a series of experiments was carried out in which partially exhausted slices (Zuckerschnitzeln) were compared with completely exhausted slices to which molasses had been added to bring them up to the same sugar content as the others, the object being to ascertain how far the envelopment of the sugar by the cell membranes, which occurs in the partially exhausted slices, protects the sugar against losses by fermentation.

In other experiments molasses were given in various combinations with other foods. The effect on the fermentation when molasses was given as a drink was also tested; in this case it is not so intimately mixed with the rest of the food as it usually is when fed together with forage or concentrates. In yet another experiment molasses was mixed with

peat, as is frequently done in practice, in order to isolate it, to a certain degree, from the other foods in the paunch by means of this substance not liable to fermentation.

I anticipate important results from a series of experiments commenced during the summer in which the same forage was given dry and ensilaged. In valuing the nutritive value of ensilage, hitherto too decisive a part has been played by the simple analysis of the food, which showed that many carbohydrates were transformed into organic acids, thus causing heavy losses of combustibles gases. It has not been sufficiently considered that the fermentations in the silos proceed to a certain extent similarly to those in the paunch, and that possibly a part of the loss by fermentation in ensilaging is made good by a reduced fermentation in the alimentary canal of animals. This question is at present under investigation in the above experiment. At the same time it will be seen whether the presence in the paunch of material already fermenting is capable of altering the normal fermentation, and, under some circumstances, of increasing or of diminishing the losses by fermentation. It will be seen from the above how complicated the question is, and how important is its solution in stock feeding. It will therefore be necessary to continue fermentation experiments on the contents of the paunch side by side with metabolism experiments in cattle, in order to isolate the different factors involved, which are, as the metabolism experiments would lead us to conclude, the result of the intimate connection between digestion and fermentation processes and of the transformations which take place in the animal organs. Already a number of Dr Markoff's experiments with paunch contents show that the presence of ensilaged food modifies very sensibly the fermentation in the paunch, and that under certain circumstances the fermentation losses are considerably diminished by it.

An important result of the experiments hitherto made, in which the 24 hours metabolism experiments in the respiratory chamber were run simultaneonsly with direct lung respiration investigations over a shorter period, is the recognition of the fact that unaltered carbohydrates scarcely enter into the metabolism of ruminants, and that, instead, all the material is transformed by fermentation in the paunch into organic acids and perhaps partially into alcohol. This is clearly seen by the relatively low values of the respiratory quotient of the animals. The low quotients are an index of the oxidation of the nutritive substances which are circulating and being burned in the body; in ruminants these are very different from those taken up in the food, which, in splitting up through fermentation, give off large quantities of carbonic acid together with combustible gases. Of this carbonic acid produced in the paunch very little is resorbed and exhaled through the lungs, the greatest quantity being passed out from the paunch through the oesophagus. In Pettenkofer's apparatus these quantities of gas mingle with the real respiration gases evolved by the oxidation of the fermentation bodies (mainly fatty acids) in the tissues of the body.

Experiments made by direct pulmonary respiration with a food whose complete combustion should give a quotient of 1.0 and even something more, on account of the formation of methane, gave figures between 0.76 and a maximum of 0.92. Parallel experiments in the respiratory chamber yielded the high respiratory quotient as calculated from the composition of the food. A very remarkable difference in the constitution of the organs in cattle and in horses is explained by this transformation of food in the paunch. In horses the liver as well as the muscles are always very rich in reserve carbohydrate (glycogen). In cattle the glycogen content of the organs is very low (1). The explanation is that, in the former the carbohydrates of the food enter as such into the circulation, whilst in ruminants these are completely reduced to fatty acids, from which, in the animal body, only very little, if any, glycogen is formed.

A further series of problems to be solved by respiratory experiments, which have been begun on Carnivora and omnivora, is that concerning the expenditure of energy required for the transformation of food into contituents of the body as it takes place in growth, in fattening, in the production of milk and in the growth of the foetus, as well as in the production of eggs in birds. Investigations into these subjects have recently been undertaken by Von der Heide and Klein (2), Dienes (3), Morgulis, Diakow and Gerhartz. A part of the results of the experiments has already been published. The whole of the work done confirms a fact that Kellner had already pointed out, but which in his works could not appear with due clearness on account of the losses due to fermentation and to the great amount of work required by digestion in herbivorous animals, namely that every assimilation of food in the body is attended by a considerable loss of energy. In other words the excess of food which is given for the purposes of production never accomplishes its object without losses. A considerable proportion is consumed in the chemical processes which transform the food material into organic substance. These losses are greatest in the laying on of proteins, as occurs in growing animals, but they are also very considerable when the fat contained in the food is deposited in the animal body during the fattening process, as has been found in Von der Heide and Klein's experiments with pigs, notwithstanding the fact that into this process chemical changes scarcely enter. The consumption of energy in the growth of the foetus and in the production of milk are more easily recognised by the experiments of Dienes. It appears that in the last days of pregnancy, during which the foetus grows most, and also during lactation, the process of combustion is increased by 26

(1) The difference is so constant that it has been used as a test to distinguish beef from horseflesh.

(2) VON DER HEIDE and W. KLEIN. Stoff und Energie Ansatz des Schweines bei Wachstum und Mast, *Biochemische Zeitschrift*, 55, p. 195, 1913.

(3) DIENES, S. Beitrag zur Kenntniss des Stoffwechsels in der Schwangerschaft und der Lactation, *Ibid.*, p. 124.

to 29 per cent. This increase is naturally greater the more organic substance is produced. Thus in the case of cows yielding much milk, besides the addition to the rations required to provide the material for the milk, a further considerable supplement must be given to cover the work of production. This supplement is estimated according to the results of preliminary experiments at from 50 to 60 per cent. of the energy of the milk produced. The experiments of Gerhartz on the transformation of energy in the laying hen are more complete than any hitherto made on the production of milk (1). In this work of production, in which a specific material in the form of eggs is produced in large quantities by the animal, the expenditure of work expressed in calories is equal to the whole combustion value of the mass produced.

I hope that with the help of the methods described above and of the investigations now under way it will be possible, in the course of the next few years, to throw so much light on the subject as to enable practical rules for the science of feeding to be drawn up.

(1) The paper is being printed in *Arch. f. d. ges Physiol.*

SECOND PART.

ABSTRACTS

AGRICULTURAL INTELLIGENCE

GENERAL INFORMATION.

LEGISLATIVE AND ADMINISTRATIVE MEASURES.

298 – **Legislative Measures Relating to the Trade in Silkworm Eggs.** — *Enquiry made by the International Institute of Agriculture.*

In order to obtain information as to the legislative measures dealing with the trade in silkworm eggs (" graine ") at present in force, the Institute addressed a circular letter in September 1913, to the Department of Agriculture of each country in which the raising of silkworms is of importance, asking whether any such measures existed in the country. Further, a special question asked whether it was obligatory that silkworm eggs for sale should have been raised by the Pasteur system.

A large number of answers were received, frequently accompanied by various publications dealing with the subject ; the following is a summary of the information received.

Australia. — No special measures or regulations exist in any of the States of the Australian Commonwealth.

Austria. — So far the necessity for special laws has not been felt, as sericulturists, of their own accord, only employ the eggs prepared on the Pasteur system, and the trade has rigourously excluded all material not so prepared. The Agricultural Experiment Station at Görz serves as a sericultural testing station, and, when required, tests the graine and grants certificates.

The Sericultural Institute at Trent, which was created by the agricultural council of the province, produces large quantities of graine, using the cellular method exclusively. The above Institute only began to supply the graine in 1885 ; at the present day it furnishes about two-thirds of the total quantity required by the country. The whole process of egg production, as well as sericultural courses for men and women, are carried ont in the building specially erected in 1894 at a cost of 340 000 crowns (over £ 14 000).

Bulgaria. — Both the internal trade and the import of graine is regulated by the « Law on the development of the silk industry in Bulgaria », which dates from January 24, 1906, and contains the following provisions:

Production of graine in Bulgaria may only be carried out under Government supervision and with the use of the cellular system.

In order to become a producer of graine a special permission is required, and the technical operations must be directed, by certificated members of the staff who have attended a sericultural course either in Bulgaria or abroad.

The despatch or consignment of graine is prohibited before March 15.

Producers of graine must give written notice to the Department of Commerce and Agriculture, previous to March 1, as to the amount of graine they intend to produce, and before April 15 must furnish a list of the silkworm raisers who have been provided with graine, as well as the amount provided in each case.

Government inspectors visit the breeding houses and make a rigorous inspection of the microscopical selection work.

In the event of disputes arising between the producers of graine and the Government authorities, matters are refered to the court of justice for trial.

The graine must be put on the market in little sacks containing exactly 10 or 30 gms.; these must be enclosed in boxes bearing the name of the firm which produced them, and the race and weight of the contained graine. Such boxes are further wrapped round with a paper band provided free by the Government. No variation of this system of packing is permitted.

Importation of graine from abroad is allowed from August to November 15 or from February 1 to March 1 if the necessary authorisation has been obtained from the Government, who also inspects such consignments. The graine must have been produced by the Pasteur system, must be pure and unadulterated, and should be accompanied by samples of the cocoons from which it was produced. Imported graine if declared marketable is provided with the official bands mentioned above, but if declared defective or infected must be redispatched abroad immediately by the consignee; in the case of failure to comply with this order within 10 days, the graine is destroyed on the spot. The official bands for imported boxes are charged 5 centimes for boxes containing 10 gms. and 10 centimes for boxes containing more than 10 gms.

The Government suspends for three or five years the importation of graine from firms who do not show proper homogeneity in their samples of cocoons.

Producers in those countries with whom Bulgaria has concluded a commercial treaty are subjected to the conditions laid down in the treaty in question.

A special convention between France and Bulgaria, dating from January 1906, regulates the import trade from that country. The graine must be produced on the Pasteur principle and imported in sacks each containing the moth or in boxes bearing a band which constitutes an official guarantee from the French government, and which allows the boxes to come through without inspection by the Bulgarian officials. Without the band the material must be examined within a month, either by the purchasor under the supervision of Government officials or by the latter themselves. The application of the Bulgarian official band is charged 1.10 fr. per 100 sacks examined if the work has been done by the Government officials, or if the work was done only under the superintendence of Government officials, the charge is 10 centimes and 5 centimes per box of 30 gms. and 10 gms. respectively.

Even with French consignments the purchasor requires Government authorisation, but this cannot be refused unless the graine sent does not correspond with the description on the official band or on the box containing the bags of graine. Importation is allowed from August 1 to December 1, or from February 1 to March 15.

China. — No laws or regulations relating to the silkworm egg trade exist. Only the sericultural schoools put on the market graine which has been subjected to microscopical examination, and such graine is put into boxes bearing the school seal, but the peasant rearers prefer to buy their graine from merchants. The latter collect eggs of various species and indicate the place of production on the wrappers, as well as append their own seal.

Besides the peasant rearers who merely raise silkworms from eggs collected themselves, exercising a rough kind of selection, there are certain rearers who make a special business of producing graine for sale.

The Department of Agriculture and Forests has brought forward proposals for laws and regulations on the silkworm egg trade and the silkworm industry generally, including preventive measures for disease etc., but at a the end of 1913 such proposals had not yet been made law.

France. — The Government control was instituted by a decree on April 26, 1907 supplemented by a ministerial instruction on April 24, 1912. Producers are not obliged to submit to the control but those who do submit receive Government guarantee for their goods.

A special inspector staff is made up of sub-inspectors who superintend the production and boxing of the graine, and of inspectors who organise and direct the operations of the above officials. The inspectors must assure themselves, by means of surprise visits, that the graine is produced exclusively by the Pasteur method, and that the conditions generally warrant the fixing of the official band to the boxes. The sub-inspectors visit the cultivators who raise the cocoons for the graine-producing establishments, as well as the latter themselves.

In the selection of the cocoons, the type and quality of each different lot is examined, and the number making up the lot is noted. Great stress is laid, of course, on the microscopical examination of both pupae and moths.

During the washing, drying, cleaning, and boxing of the eggs, the sub-inspector has to see that no adulteration takes place. He is further responsible for marking the exact weight of eggs on the official band of each box, as well as the name and address of the producer, and the race and colour of the cocoons.

Producers of graine who wish to be under Government control must send in to the State Department of Agriculture a special form every year before March 31, in which they undertake to subject themselves to all the prescribed regulations for both the internal and the external trade, and to furnish Government officials with all the necessary facilities for carrying out their work of inspection.

Greece. — No special regulations exist, but the Government meditate bringing in such measures shortly.

Hungary. — All matters relating to sericulture and the silk industry have been in the hands of a special government department since 1880, *viz.* " The Royal Inspectorate for the Development of the Silk Industry in Hungary ". It was decreed by law in 1885 that the Inspectorate alone

should have the right to distribute gratis to all who wished to rear the worms, graine produced by the Pasteur system. The cocoons are then acquired by the Government at a fixed price of 2.35 crowns per kilo (10 ½ *d* per lb.), in which allowance has been made for the value of the graine distributed free. The Government has erected a Sericultural Institute at Szekszard ; in this 280 microscopes are kept in use, selecting annually 6 to 7 million pairs of moths for the cells, each pair being subjected to microscopical examination by three different members of the staff. To maintain the racial vigour, about two million cells containing moths are imported annually from Italy or France, and the graine produced by these couples is distributed the following year.

India and British Crown Colonies. — No special regulations exist. In India attempts have been made to induce cultivators to use selected graine exclusively, and facilities for its acquirements have been granted in silk-raising districts. In Ceylon imports of graine have been limited to selected material from Italy or from the Government establishment in Kashmir, and such precautionary measures will undoubtedly be continued in future.

Italy. — No special regulations exist other than art. 15. of the law No. 869, July 6, 1912, dealing with the silk industry, in which it is stated that all silkworm eggs consigned by post or railway and gone astray in transit must be destroyed instead of being sold as is usually the custom with lost goods. Nevertheless there are numerous firms which carry on a business in graine both at home and abroad and which produce their eggs on the Pasteur system and guarantee the material they supply. Further, the two Royal Experimental Stations of sericulture of Padua and Ascoli Piceno, as well as the Sericultural Departments of the Royal Agricultural Colleges of Milan, Portici and Perugia, and numerous other small sericicultural stations (" osservatori ") exert a considerable beneficial influence on the commerce of graine.

Japan. — There exists a fundamental law for the silkworm egg trade dating from March 29, 1911, No. 47, which is known as « san-shi-gyo-ho." Other regulations concerning the execution of this law are as follows:

a) Imperial decree of July 29, 1911 (No. 214), on the right of inspecting graine.

b) Imperial decree of November 22, 1911 (No. 276), on the organisation of a committee for the inspection of graine.

c) Decree of the Department of Agriculture and Commerce of November 3, 1911 (No. 30), relative to the application of the above law.

d) Instructions issued by the Department of Agriculture and Commerce, December 16 1911 (No. 19) relating to the said law.

e) Notification from the Department, December 6. 1911 (No. 571), relative to preventive measures against silkworm diseases.

f) Ministerial decree, 1911 (No. 31), with regard to the organisation of the Bureau of Inspection for Sericulture.

g) Ministerial decree, May 1, 1911 (No. 21), relating to the subvention granted for encouragement of improved methods in the production of graine.

Japanese law lays down that all graine put on the market must have been produced by the Pasteur system, details being given in the above - mentioned document (*e*).

Roumania. — No special laws are in existence. Imports are all subjected to examination by the sericultural station before being allowed to circulate in the country. All graine must be produced by the Pasteur system and be free from all disease.

Russia. — No special laws exist, but measures are now being discussed in this connection.

Spain — A royal decree dating from May 16, 1913, prohibits all imports from France unless the latter bear the official bands which constitute a Government guarantee. Imports from other countries are subjected to no special regulations and the graine may be either cellular or industrial ; in fact, it more usually consists of the industrial variety.

299 – **The Institution of a Technical Commission of Agricultural Meteorology at the " Direction générale des Eaux et Forêts " in France.** — *Ministère de l'Agriculture, Bulletin mensuel de l'Office des Renseignements agricoles*, Year 13, No. 1, p. 8. Paris, January 1914.

By a Ministerial Decree of January 6, 1914, a technical commission of Agricultural Meteorology has been established at the French Ministry of Agriculture. The commission consists of 30 members who are nominated for three years by Ministerial decree, and it is attached to the " Direction Générale des Eaux et Forêts ». Its duty is to give its opinion upon the studies to be carried out in the different agricultural districts of France, upon the establishment and management of the Stations and Posts of Observation and upon all question laid before it by the Ministry of Agriculture.

DEVELOPMENT OF AGRICULTURE IN DIFFERENT COUNTRIES.

300 – **Some Data on the Agriculture of the German Protectorates.** — *Die deutschen Schutzgebiete in Afrika und der Südsee* 1912-13, *Amtlicher Jahresbericht, herausgegeben vom Reichs-Kolonialamt*, pp. 82-111 and 121-128. Berlin, 1914.

The following data on the agriculture and trade of the German Protectorates are taken from the official report of 1914 published by the Imperial Ministry for the Colonies on the German Protectorates.

Among the various branches of German colonial economy, agricultural produce occupies the first place. During the year dealt with by the Report, the plantations enjoyed, in the main, favourable market conditions, as the effects of the low prices for rubber were not yet much felt. The rubber plantations in Germany East Africa have been considerably extended. Sisal yielded a good crop which sold easily at good prices. The production of coffee increased. The plantations in Kamerun are progressing ; a new branch, bananas, has a good prospect for the future, owing to the formation of a firm for their export. In Togo the plantations have increased in number and in extent. In German New Guinea also, the area under plantations has considerably increased. It is satisfactory to note the progress in the growing of other produce, such as rubber and cacao, besides coconuts, because the exclusive production of copra presents serious drawbacks from the point of view of colonial economics. At Samoa the cultivation of Hevea has made much progress.

TABLE I.

	German East Africa		Kamerun		Togo		South Sea Protectorates			
							German New Guinea and islands		Samoa	
Total area	1 339 637 acres		284 539 acres		28 091 acres		457 000 acres		122 460 acres	
Number of plantations	707		58		—		—		34	
White employees	606		195		9		212		81	
Coloured labourers	83 366		17 827		841		15 116		2 118	
Crops	Cultivated area		Cultivated area		Cultivated area		Cultivated area		Cultivated area	
	Total acres	Productive acres	Total acres	Productive acres	Total acres	Productive acres	Total acres	Productive acres	Total acres	Productive acres
Maize	9 365	9 365	—	—	—	—	—	—	—	—
Rice	1 152	1 152	—	—	—	—	72	32	—	—
Sugarcane	341	341	—	—	—	—	94	94	—	—
Other cereals	5 807	5 807	—	—	—	—	7	5	—	—
Coconuts	20 209	4 900	—	—	1 628	660	73 228	26 540	12 080	9 585
Oil palms	257	15	12 564	4 070	145	—	—	—	—	—
Pineapples	—	—	—	—	—	—	10	10	25	25
Bananas	383	383	5 347	976	—	—	12	5	238	238
Fruit trees	608	608	—	—	—	—	—	—	—	—
Other fruit	568	568	—	—	—	—	158	158	23	23
Cacao	297	173	32 522	20 201	452	198	974	507	8 928	3 740
Coffee	11 869	5 414	264	25	—	—	22	15	7	7
Tobacco	40	40	378	227	—	—	7	7	—	—
Spices	(Pepper) 136	136	(Kola) 405	44	(Kola) 1	1	(Kola and nutmeg) 20	5	(Kava(*) 47	47
Rubber	111 982	42 295	18 291	2 555	430	49	5 780	2 963	2 871	533
Cotton	31 978	41 978	—	—	—	—	—	—	—	—
Kapok	6 504	1 584	—	—	12	—	—	—	18	18
Manila hemp	—	—	—	—	—	—	20	15	—	—
Mauritius hemp	—	—	—	—	—	—	—	—	—	—
Sisal hemp	61 162	35 482	—	—	650	168	193	69	—	—
Pourcroya	—	—	74	54	—	—	—	—	—	—
Total	262 657	140 242	69 745	28 152	3 318	1 076	79 597	30 425	25 237	14 216

(*) *Piper methysticum.* (*Ed.*).

Table I gives a synopsis for 1912 of the plantations belonging to Europeans in all the German Protectorates.

Farming in German South-West Africa has not yet felt all the benefits expected from the new railways, but it has nevertheless developed very satisfactorily. Notwithstanding the small amount of rain and the poor pasturage, the live stock of the farms has increased as well as the number of the latter. In 1913 there were 1 331 farms comprising 33 096 806 acres, against 1 245 farms with 32 001 861 acres in the previous year.

Table II shows the number of head of Live stock in German South-West Africa in 1912 and 1913 and those of East Africa and German New Guinea in 1913.

TABLE II.

Live stock	German South-West Africa		German East Africa 1913		German New Guinea 1913
	1912	1913	belonging to Europeans (501 farms)	belonging to natives (*)	
Cattle	171 784	205 643	43 617	3 950 250	2 572
Sheep for wool	46 901	53 691	41 647	6 398 000	sheep 891
Persian sheep	12 588	17 171			
Karakul sheep	4 094	11 194			
African sheep for meat	422 481	472 585			
Angora goats	10 387	18 163			goats 556
Horses	448 279	485 401			
Asses	13 340	15 916	202	10	421
Common goats	7 015	8 563	2 543	22 091	17
Mules	4 879	5 055	375	52	6
Pigs	7 195	7 772	5 460	497	2 706
Camels	789	709	—	38	—
Ostriches	1 277	1 507	173	—	—
Poultry	71 753	87 386	—	—	15 019

(*) The figures of this column are mostly estimated.

The establishments of the Administration for the Promotion of Agriculture have continued to develop and have displayed great activity, especially in German East Africa, where their number has reached eight. Extensive veterinary measures for the control of cattle plague have been organized in the colony. The campaign against the diseases of live stock has been continued in German South-West Africa. In German New Guinea the bases of a veterinary service have been laid.

In Samoa agricultural experimentation has been newly organized and special attention is paid to the phytopathological service, while it continues its development in German New Guinea.

For forestry the chief measures have consisted in the creation of new forest reserves, especially in East Africa and in Togo. The forest reserves n East Africa extended, in 1913 (April 1), over an area of 1 833 817 acres, against 1 197 040 in 1912.

The foreign trade of all the Protectorates rose in 1912 to £12 890 000 (£11 760 000 in 1911), which is principally due to the total increase of Trade in East Africa ; this rose from £2 330 000 to £2 970 000. The total import trade of all the Protectorates has risen from £6 968 398 to £6 991 268 ; while the exports have risen from £4 801 818 to £5 923 126. To this increase of exports German South-West Africa has contributed £540 000 and German East Africa £440 000.

Table III shows the principal animal and vegetable products exported, arranged according to value.

TABLE III.

	£		£
Rubber	1 036 242	Timber	41 829
Copra	573 520	Wax	40 624
Palm kernels	381 500	Cattle	26 259
Sisal	361 114	Sesame	25 662
Cacao	265 296	Maize	14 150
Hides	212 268	Butter, milk, etc.	12 630
Palm oil	148 727	Rice	9 646
Cotton	128 621	Kola nuts	8 181
Coffee	93 284	Wool	7 333
Earthnuts	62 380	Tanbarks	4 892
Ivory	46 011	Ostrich feathers	4 753

EDUCATION AND EXPERIMENTATION IN AGRICULTURE AND FORESTRY.

301 – **The Establishment of a Laboratory at the Marseilles Colonial Institute for the Study of Cereals and other Starch-producing Plants.** — PERROLI, EM. in *La Quinzaine coloniale*, Year 17, No. 34, pp. 861-862. Paris, December 25 1913.

The Marseilles Colonial Institute has decided to erect a laboratory for the special study of cereals and other starch-producing plants cultivated in the French possessions. This laboratory will be furnished with all the apparatus necessary for grinding and baking experiments with cereals, for husking, bleaching and testing the hardness of rice, and for experiments on obtaining starch and alcohol from other starch producing plants. These technical investigations will be supplemented by the necessary botanical determination of the plants, and by their chemical analysis.

AGRICULTURAL SHOWS AND CONGRESSES.

302 – **Agricultural Shows.**

Austria.

1914 June-July. Vienna. — Flower show of the Imperial Horticultural Society. Offices: 12 Kaiser Wilhelmring, Vienna.

Sept. 5-8. Bruck. — Agricultural and industrial show, organized by the "Niederösterreichischer Landeskulturrat" in conjunction with the municipality of Bruck and the local Agricultural Association. Offices of the "Landeskulturrat": Stallburggasse, 2, Vienna I.

Belgium.

1914 Aug. 15-18 Huy. — Septennial International Horticultural and Agricultural Show. Adress to : M. Paul Maréchal, Statte Huy, Belgium.

Nov. 7-9. Brussels, Grand Hall du Cinquantenaire. — International Poultry Show, organized by the " Société centrale d'Aviculture de Belgique ". Offices : Royal-Bourse, rue Henri-Mans 13-14, Brussels.

France.

1914 May 26-31. Caen. — National poultry show, organized by the " Société d'Aviculture de la Basse-Normandie ". M. Hédiard, 37 rue de Bretagne, Caen.

May 29-June 1. Biarritz. — International Show of Horticultural Produce, held at the time of the 18th Congress of the " Amis des Roses, Société française des Rosiéristes ", under the auspices of the " Société d'Acclimationta du Golfe de Gascogne ". M. Hurn-Sentouré, general sec., Société d'Acclimatation, Biarritz.

June. Paris. — Exhibit of useful and injurious insects and of insectivorous birds, under the patronage of the Ministry of Agriculture. The profits will go towards the foundation of Entomological Stations and Laboratories.

June 16-21. Paris, Champ de Mars — Second General show of Breeding Stock (cattle, sheep and pigs) organized by the Minister of Agriculture. The show of stud horses and asses will be held at the same time.

Germany.

1914 Frankfort-on-the-Oder. — Three Horticultural Shows will be held by the Frankfort Horticultural Society in connection with its fiftieth anniversary, *viz.* : May 2-4, Aug. 15-17 and Sept. 19-21. Director : H. Steffen, Gebenerstrasse 18, Frankfurt a-O.

May 23-26. Magdeburg. — 25th show and sale of horses and exhibition of agricultural machines, with show of sheep, sheep-dogs and poultry.

Hungary.

1914 September. — The sale and show mentioned in *B.* March 1914, p. 325, has been put off to September.

Italy.

1914 Autumn. Vercelli (Piedmont). — Competition for mechanical cultivation of rice-fields, organized by the " Stazione Sperimentale di Risicultura ".

Rumania.

1914 May. Bukarest. — Agricultural show with competition for motor ploughs.

Russia.

1914 May 20-June 7. Warsaw. — International show of agricultural machines with internal combustion-engines, organized by the Central Agricultural Society of Poland.

Union of South Africa.

1914 Agricultural shows : May 6-7, Hooptad (Orange Free State) ; May 22-25, Pretoria ; June 11-12, Pietersbury (Transval) ; July 7-10, Durban.

United Kingdom.

1914 June 30-July 4. Shrewsburg — Royal Agricultural Society's Show.

July 7-8. Cork. — Munster Agricultural Society's Show.

July 21-23. Newport (Mon.). — Welsh National Agricultural Society's Show.

Nov. 19-21. Norwich. — Fat stock show of the Norfolk and Norwich Christmas Show Association.

Dec. 7-11. Islington. — Fat stock show of the Smithfield Club.

303 – **Agricultural Congresses.**

France.

1914 May 29-June 1. Biarritz. — 18th Congress of the " Amis des Roses, Société française des Rosiéristes ". M. Hurn-Sentouré, general sec. of Société d'Acclimatation, Biarritz.

Sept. 4-6. Lyons. — Annual congress arranged by the "Union nationale des Sociétés d'horticulture de France". Special subject: fruit-growing and the fruit trade. M. Charles Balter, sec. of the Union, Faubourg de Croucels, Troyes.

Sept. 7 (opening). Grenoble. — Pomological Congress, organized by the "Société Pomologique de France".

CROPS AND CULTIVATION.

AGRICULTURAL METEOROLOGY.

304 – **The Frequency of Low Temperatures in the Sudan and its Effect on the Cotton Crop.** — HURST, H. E. in *The Cairo Scientific Journal*, Vol. VII, No. 87, pp. 265-268. Giza, December 1913.

During the season 1910-11, a very poor cotton crop was obtained at Atbara; this was attributed to the low temperatures experienced in the months of November and December. The actual temperatures registered were 12 readings of 11° C. or lower, while in ordinary years only about 4 such low readings are registered, so that the damaging limit lies probably between 4 and 13 occurrences of 11° C. or lower. The writer tabulated the frequencies of low temperatures (11° C. or lower) registered at various points in the Sudan during the years 1902-1912, and then calculated the probability of the occurrence of 8 or 9 such low temperatures in one year at these different points. He points out that the results are only approximately correct, as the available records only cover a small number of years, also that more research is required as to the actual temperature conditions required to damage the cotton crop; but, assuming that low temperature alone was responsible for the damage to the cotton crop at Atbara in 1910, the results indicate that cotton cannot be grown in the neighbourhood of Atbara and Dueim without considerable risk, while at Khartoum the risks are less, though further investigations are required to define them exactly; but at Wad Medani, Kassala and Tokar there seems to be little danger from cold weather.

An accompanying chart shows that the dividing line between safe and doubtful districts seems to follow roughly the isotherm of mean minimum temperature for the time of year of 16° C. Consequently, before much cultivation is commenced in the Western Gezira, the exact effects of low temperature on the growth of cotton should be investigated.

305 – **Rainfall and Spring Wheat.** — BLAIR, T. A. in *Monthly Weather Review*, Vol. 41, No. 10, pp. 1515-1517. Washington, October 1913.

The influence of rainfall on the yield of spring wheat is estimated by calculating the departure from the normal of the annual yields, and of the rainfall, during the months of May and June, for the 22 years 1891-1912. The data refer to the States of Minnesota, North Dakota, and South Dakota, and the results indicate that while the rainfall during the growing season is the chief determining factor with regard to the wheat yield in the two Dakotas, this is probably not the case in Minnesota, where much of the land is badly drained, and the best crops are obtained in years when the precipitation is normal or slightly subnormal.

306 – **Relation of Precipitation to Tree Growth.** — STEWART, M. N. in *Monthly Weather Review* (*U. S. Dep. of Agr.*), Vol. XVI, No. 9, p. 1287. Washington September 1913.

The width of the rings in an oak stump was measured and compared with the rainfall records of the district over a period of 75 years. June and July appear to be the two months whose rainfall is most closely connected with tree growth; considering only the precipitation of these two months, practically all rings more than 10 per cent. below the average width were formed in years of subnormal rainfall, while 62 per cent. of the rings above the average width correspond with years when the rainfall was above the average.

307 – **Recent Studies of Snow in the United States.** — CHURCH, J. E. Jun. (University of Nevada) in *Quarterly Journal of the Royal Meteorological Society*, Vol. XL, No. 169, pp. 43-52. London, January 1914.

A description of the instruments used by the writer in surveys, and of his methods of working, together with some observations on the relation of mountains and forests to the conservation of snow, the principal results of which have already appeared in this *Bulletin* (1).

308 – **On a New Method of Measuring the Capillary Lift of Soils.** — LYNDE, C. J. and DUPRÉ, H. A. in the *Journal of the American Society of Agronomy*, Vol. V, No. 2, pp. 107-116. Lancaster, Pa., April-June, 1913.

SOIL PHYSICS, CHEMISTRY AND MICROBIOLOGY.

Small glass funnels (4 cm. in diameter across the top) were fitted with cotton cloth filters, cut in the form of a circle 2 cm. in diameter and folded like a filter paper. Soil samples were boiled in water, and a little of the hot mixture was poured on to the filter, the funnel was placed in a centrifuge cup, already containing water, and centrifuged, the process being repeated till the layer of soil settled on the filter reached well above the edges of the cotton cloth fibres. The lower end of each funnel was then connected with a vertical capillary tube filled with water, the other end of the tube dipping into a basin of mercury, so that the whole constituted a continuous water column from the lower surface of the soil layer to the surface of the mercury. As water evaporated from the upper surface of the soil, the mercury rose in the capillary tube and the *capillary lift* could be measured. A subsoil containing 74 per cent of clay and various soil fractions were tested as follows: (Table I).

The theoretical capillary lift was calculated for the different soil fractions, and in all cases except the clay fraction, the observed values fell between the limits of the calculated values. In the case of the clay, the calculated value surpassed 34 feet of water or the height of a column supported by one atmosphere. Some soils that were tried also gave higher calculated values than 34 feet of water, and in all these cases the observed values remained below the 34 feet. From this, the writers concluded that the pressure of the atmosphere limited the capillary lift which could be observed, and therefore, that if the pressure were increased, it would follow that the capil

(1) See No. 462, *B.* May 1913.

TABLE I.

Soil	Diam. of soil particles	Capillary lift	
		Mercury column	Equivalent water column
	mm.	cm.	feet.
Subsoil containing 74 % of 'clay'	—	67.5	30.1
Sand (medium)	0.5–0.25	2.2 2.1	0.98
Sand (fine)	0.25–0.1	4.0 3.9	1.78
Sand (very fine)	0.1–0.05	9.1 8.8	4.05
Silt	0.05–0.005	22.4 21.3	9.99
Clay	0.005–	60.1 55.9	26.80

lary lift would be increased too, and vice versa. To this end the whole apparatus described above was enclosed in a glass case where the pressure could be controlled, and, working with clay the following results were obtained : (Table II).

TABLE II.

Pressure cm. of mercury		Capillary lift, cm. of mercury
76	Normal	55.9
76	Pressure	60.1
99.5	. . . . .	86.3
104.2	. . . . .	78.4
61.3	. . . . .	56.3
56.3	. . . . .	44.3

The writer points out that one of the great advantages of this new method of measuring the capillary lift is the rapidity with which observations may be made. In the experiments on the subsoil given in Table I the lift of 30.1 feet took place in 20 hours.

309 – **On Osmosis in Soils: The Efficiency of the Soil Constituents as Semi-permeable Membranes.** — LYNDE, C. J. and DUPRÉ, H. A. in *the Journal of the American Society of Agronomy*, Vol. V, No. 2, pp. 102-106. Lancaster, Pa., April-June, 1913.

In previous investigations (1), it has been shown that a clay subsoil, centrifuged into a dense layer about 2 inches thick, or more, in the bottom of a

(1) See No. 645, *B.* June 1913.

cylinder, acts as a semi-permeable membrane whose efficiency varies with the depth of the column of clay. In the present paper, the efficiency of the various soil fractions to form this membrane was tested with the following results :

Soil fraction	Diameter of particles	Depth of soil colomn	Osmotic pressure per sq. cm.	Resistance of solution	Efficiency of soil column compared with a perfect semi-permeable menbrane
	mm.	cm.	gms.	ohms.	per cent.
Sand (medium)	0.5 –0.25	7	0	—	—
» (fine)	0.25 –0.1	7	0	—	—
» (very fine)	0.1 –0.05	7	0	—	—
Silt	0.05 –0.005	8	0.2	850	0.07
Clay	0.005-0.001	6.5	4.4	1 400	2.6
Fine clay	0.001–	5.5	42.0	1 500	27.1
Clay remaining in suspension for a week . .	—	6.0	315.0	—	—

The efficiency increased as the size of the particles diminished, and, while fractions made up of particles over 0.05 mm. in diameter were quite ineffective, that consisting of particles which had remained in suspension for a week had already reached an osmotic pressure of 315 gms. per sq. cm. when the article went to press, and the pressure was still increasing. The solutions used were clay subsoil solutions.

310 – **Estimation of the Surface of Soils.** — HANLEY, J. A. (Rothamsted Experiment Station) in *The Journal of Agricultural Science*, Vol. VI, No. 1, pp. 58-62. Cambridge January 1914.

An investigation into the possibility of estimating colloids in soils by means of dye solutions.

Three soils were selected which contained 3 per cent, 8 per cent, and 20 per cent of clay respectively, and 12 solutions of methyl violet were prepared varying in strength from 0.25 gms. to 3 gms. per litre. Five grams of air dry soil were shaken up with 100 cc. of each solution, and left in contact for 48 hours, then part of the top solution was pipetted off, diluted suitably, and the dye estimated colorimetrically by means of Nessler tubes and a standard dye solution. The amount of dye absorbed per 100 dry soil was calculated, and plotted against the concentration of the final solution.

The results yielded three curves which show that when compared on the basis of the concentration of the final solution instead of that of the original solution, the ratio between the amounts of dye absorbed by the three soils remains practically constant for various concentrations, and is

equal to 0.74 : 0.86 : 1 for the soils containing 3, 8, and 20 per cent of clay respectively. In other words, to obtain relative values indicating the active surfaces of different soils, it is necessary that each soil be brought into equilibrium with a solution of the same strength, and as some soils absorb more dye than others, a solution of different strength must be used for each soil.

The writer adopted a standard equilibrium solution of 0.05 per cent, and is continuing his investigations as the method is simple and likely to prove useful as an index of certain physical qualities in soils.

311 – **The Humus of Acid and Alkaline Peats.** — HANLEY, J. A. (Rothamsted Experiment Station) in *The Journal of Agricultural Science*, Vol. VI, No 1, pp. 63-76. Cambridge, January 1914.

A collection of peats, received atthe Rothamsted Laboratory from various parts of England was investigated with a view to establishing a chemical distinction between the different classes of such soils, and more especially between the alkaline or normal peats and the acid peats.

In 35 soils the humus was extracted with 4 per cent ammonia before and after treatment with $\frac{N}{5}$ hydrochloric acid, and the results showed that a soil might be alkaline, and yet have a considerable amount of its humus soluble in ammonia without previous acid treatment. In a number of calcium carbonate determinations carried out simultaneously, no soil acid to litmus contained carbonate, while all the alkaline soils did.

Five soils were then selected for more detailed study along the following lines : the nitrogen was estimated in the ammonia extracts obtained before and after acid treatment, and in similar extracts made with a soda solution of equivalent strength to the 4 per cent ammonia ; the proteins were hydrolysed with 20 per cent hydrochloric acid and the ammonia thus formed was estimated; finally the soils were boiled in a sucrose solution, and the amount of sugar inverted was estimated. At the same time water cultures were carried out where the only source of nitrogen to the plants was supplied in the form of the peat itself added to each bottle.

Of these various methods of comparison : the alkaline extracts yielded no safe guide to the acidity of a soil though soda gave more significant results than ammonia in this respect. Neither was the hydrolysis of proteins of any use in discriminating between peats, the yield of ammonia with 20 per cent hydrochloric acid being very low in normal peats, and nil in acid peats. On the other hand, the inversion method apparently yielded useful results which agreed closely with the general characteristics of the peats, and this method of comparison was extended to a number of other peat soils. The reaction being one in which neutral compounds cannot taken part, and depending on the concentration of the acid present, the alkaline or normal soils always gave lower results than acid soils, and treatment with 5 per cent hydrochloric acid invariably led to an increase of the inverting power of a soil though every precaution was taken to get rid of the last trace of hydrochloric acid. Moreover normal fertile soils, which would be expected

to contain a large proportion of their organic matter as available humus, always gave more " total inversion " than acid soils.

312 – **The Solution and Precipitation of Iron in the Formation of Iron Pan.** — MORISON C. G. T. and SOTHERS, D. B. (School of Rural Economy, Oxford) in *The Journal of Agricultural Science*, Volume VI, Part I, pp. 84-96. Cambridge, January, 1914.

The formation of iron pan, or Ortstein, which is of fairly frequent occurrence in Europe, has been accounted for by three different theories. According to the first and second theories, the phenomenon is due to the alternate reduction and oxidation of iron compounds — humates in the one case, and oxides in the other — the reduction being brought about by the organic matter in the peat, and being followed by the solution, washing down, and subsequent oxidation and re-deposition of the iron compounds at the pan level. The third and more modern theory considers the formation of pan to be due to colloidal humus compounds of iron and aluminium which are carried down into the soil and there precipitated by soluble salts, by loss of water, or by change of bases. The experimental evidence in support of this last theory did not appear conclusive, and for this reason the writers re-examined the subject.

They worked with iron compounds, as both the ferrous and the ferric ions yield very delicate tests.

In a preliminary set of experiments in which soil, ferric oxide or powdered limonite was boiled with peat and various reagents, it was shown that though the peat had a strong reducing action on any iron salts present, it had no direct action on ferric oxide itself, unless some body capable of bringing small quantities of iron into solution were present. As ammonium chloride was apparently the most efficient reagent for this purpose, it seemed possible that ammonium salts present in peat might play some part in aiding the solution of ferric oxide in the soil, especially as, on analysis, the ammoniacal nitrogen of a series of peats proved in most cases very many times greater than that found in ordinary soils.

A second series of experiments was therefore carried out, in which precipitated ferric hydroxide was shaken up 1) with water containing carbon dioxide, 2) with humic acid, 3) with both these substances, and 4) with ammonium chloride in addition; in other bottles, soil was shaken with peat and carbon dioxide water, with and without ammonium chloride. Neither at ordinary room temperature not at 20° C. could any ferrous or ferric reaction be detected in the solution ; under these circumstances, therefore, the ammonium chloride had no effect in bringing iron into true solution. But when these same solutions were evaporated to dryness and ignited, and the residues were redissolved in hydrochloric acid, the reaction for ferric iron was obtained, showing that the original solution must have contained some iron in the form of a complex ion or a colloid sol.

In a further set of experiments an attempt was made to measure the amount of iron thus removed. The results, though not very reliable, confirmed the evidence obtained previously, in that conditions which would increase or decrease sol formation also increased and decreased the amount of iron present.

Again, a solution of ferrous humate was prepared by heating together peat, distilled water and iron filings; the solution obtained gave a strong ferrous precipitate with potassium ferricyanide. When oxidised with hydrogen peroxide, a slight brown precipitate was formed ; on filtering this off, the resulting solution, though it gave no reaction for ferrous or ferric iron was shown to contain a colloidal sol of iron, similar to those obtained before. Whether this is a colloidal sol of true ferric humate or a colloidal absortion complex of colloidal humus and colloidal ferric hydrate is not yet clear.

Lastly, on analysing the residue of a solution containing such a colloid suspension extracted from a soil, it was found to consist mainly of iron, aluminium and calcium, with traces of magnesium, showing that aluminium and calcium are also involved in the formation of the pan.

The writers follow out the process of pan formation according to the evidence obtained in their experiments, as follows : one of the first results of the accumulation of the surface layer of peat is the production of substances showing acid properties, which will remove the more readily attacked constituents of the soil — probably in the state of true solution. At the same time there are formed colloidal humates of iron, aluminium and calcium, but, owing to the fact that the soil solution is at first comparatively concentrated, these colloids are probably in the gel form, and are not removed from their original position. When the soil solution has become sufficiently dilute, the gels assume the sol form, and are removed from the layer which ultimately becomes the bleached sand layer lying immediately under the peat (*i. e.* go into suspension in the soil solution). This occurs during the wetter part of the year. As the soil dries up, the water recedes from the surface, and the major part of the colloidal suspension is taken with it. As desiccation proceeds, the soil solution becomes more concentrated with respect to the colloid, and deposits more ferric humate at the lower level, and, owing to the negligible osmotic pressure of the colloid sol, little diffusion will take place. Consequently desiccation will be more rapid than diffusion, and the whole of the material in suspension will be deposited. When the wet season recurs, the coagulated and desiccated colloids will not entirely go back into suspension, as the colloid character may well have been changed during the process of desiccation.

It is conceivable that some of the the iron bacteria may play a part in the formation of the pan, but the writers consider that it is possible to account for its formation without the intervention of living organisms.

313 – **Ferrous Iron in Soils**. — MORISON, C. G. T. and DOYNE, H. C. (School of Rural Economy, Oxford) in *The Journal of Agricultural Science*, Vol. VI, No. 1, pp. 97-101. Cambridge, January 1914.

The writer shows that the present methods of estimating ferrous iron in soils are quite unsatisfactory. They consist essentially in the use of dilute acid as a solvent, and of subsequent titration with potassium permanganate. As has been shown previously (1), soils boiled with such dilute

(1) See No. 312 *B*. April 1914.

acids, in presence of organic matter, have their ferric salts reduced to ferrous, therefore the amount of ferrous iron estimated depends on three independent factors :

1) The amount of ferrous iron present,
2) » » » soluble ferric iron present,
3) » » » organic matter present.

314 – **The Nature and Amount of the Fluctuations in Nitrate Content of Arable Soils.** — RUSSELL, E. J. (Rothamsted Experimental Station) in *The Journal of Agricultural Science*, Vol. VI, No. 1, pp. 18-57. Cambridge, January 1914.

Systematic determinations of the nitrate content of soils were carried out during the four years 1909-13, the results of which are brought together in the above paper. The soils studied varied from sands to clays, and they were sampled to a depth of 18 inches in two layers (0—9 in. and 9—18 in.), each layer being considered separately.

The results disclose the remarkable fact that the accumulation of nitrates in the soil takes place most rapidly in late spring or early summer (Mays, June, July), and not in the late summer as in often stated, the actual period of the rise varying with the character of the season, being earlier after a dry cold winter than after a wet mild one. Subsequently to this accumulation, the nitrate content appears to depend partly on the nature of the soil and its treatment, and partly on the season. On fallow land, there is usually little, if any, subsequent gain, and frequently a loss, but in the hot, dry season of 1911 the accumulation continued on some soils right on till September.

The maximum nitrate content of the soils rarely exceeded :

6 parts of nitrogen per million of dry soil, or 28 lbs. per acre for a sand,
23 » » » » » » » » » 115 » » » » » loam,
(excepting on heavily dunged land when it rose to 37 parts per million)
14 parts of nitrogen per million of dry soil or 60 lbs. per acre for a clay.

Loams showed greater fluctuations in nitrate content than either clays or sands. Clays lost less nitrate in winter, but also accumulated less in June and July, while sands were reduced to the same low level as the loams in winter and never accumulated much in summer. The rainfall during the winter greatly affected the amount of nitrate lost by loams and sands, a wet autumn or winter proving very disastrous, and much evidence was accumulated in this connection to show that all winter losses of nitrate are due to leaching rather than to denitrification.

On cropped land, the nitrate content was always lower during the late summer and early autumn than on corresponding follow land, even after allowing for the nitrogen taken up by the crop. In fact no evidence could be obtained that any nitrate was being produced during the time of active plant growth in the hot summer of 1911, although nitrate accumulation was taking place on adjacent fallow land. In some cases the nitrate content rose again after harvest. Moisture determinations and temperature readings on fallow and cropped soils only showed small differences, but it

is impossible to say how far these reacted on the rate of nitrate production. Other observers have noted this same phenomenon of a reduced nitrate content on cropped soils in such dissimilar localities as India, New York State, and Paris, but no solution is at present suggested to explain the results.

The investigation included a study of variously manured plots ; ammonium salts nitrified more or less rapidly and completely according to the season and the time of application. Ammonium salts applied in February 1909 were not completely converted at the end of 7 weeks, but another dressing applied in April was completely nitrified in 4 weeks. With regard to the residual effect of ammonium salts, plots habitually receiving annual dressing of ammonium salts contained more nitrates than similar unmanured plots, though none had received dressings in the actual year of the experiment ; but when the matter was investigated on two Broadbalk wheat plots which received ammonium salts in alternate years, no evidence of residual nitrogen was obtained.

The writer points out that the general conditions favouring nitrate accumulation are also those favouring crop production. He tabulates two sets of Rothamsted experiments which show clearly the depressing effects of wet winters on crop production, and how intimately this is connected with the leaching out of the nitrate. He further remarks that it is important that agriculturists should realise what great accumulations of nitrate occur in the soil at the end of a dry summer, and how complete may be the loss on loams and sands during a mild, wet winter: 50 lbs or more of nitrogen per acre may easily be lost while the land lies bare between harvest and seed time, and this amount is all that is taken out of the soil by a 32 - bushel wheat crop. As time goes on and the price of nitrogen manures rises, the problem of reducing winter losses of nitrate is likely to increase in importance, and it is now being attacked by experiments in green manuring.

Results obtained by Leather at Pusa, and Jensen in South Dakota, are discussed in their bearing on the present investigation ; they support the general rule that when a period unfavourable to nitrification comes to an end, and more favourable conditions set in, the rate of nitrate accumulation tends to be more rapid in the early part of this new period than later on.

Though other investigators have suggested other reasons for this phenomenon, the matter is readily explainable on the view that the soil population is complex and includes two groups of organisms, one of which is engaged in the production of plant food, while the other is detrimental and somewhat more readily put out of action by adverse conditions.

The method of estimating nitrates at the Rothamsted Laboratory is given in detail. It consists of reduction by means of a zinc-copper couple, and has yielded very reliable results over a large series of trials.

315 – **The Effect of Heat on Hawaiian Soils.** — KELLEY, W. P. and MCGEORGE, W. in *Hawaii Agricultural Experiment Station, Bulletin* No. 30, pp. 5-38. Washington, D. C., December 1913.

Hawaiian soils are characterised by : 1) the peculiar properties and high percentage of the clay; 2) the inertness of the unploughed and unbro-

ken sod lands. A field ploughed for the first time, even when reduced to a state of fine tilth, usually will not support plant growth satisfactorily, so that local farmers find it necessary to aerate newly ploughed lands for a period of several months before planting the first crop.

Heat, however, appears to be able to accomplish the effects of aeration, since excellent growth of crops is obtained on plots where brushwood has been burned, even when applications of fertilisers are unsuccessful.

In these experiments, twelve different soils representing a wide range of types and agricultural conditions were studied with reference to the effects of heating to 100° C., to 250° C. and to ignition. The solubility of all the mineral constituents, except soda, was determined, using water and $^{N}/_{5}$ nitric acid as solvents. A study of the changes that take place in the individual nitrogen compounds was also made.

The results showed considerable variation with regard to the absolute and relative solubility of the inorganic constituents in the different samples. Drying at 100° C. was found to bring about an increase in the water-soluble manganese, lime, magnesia, phosphoric acid, sulphates and bicarbonates. The solubility of potash silica and alumina was increased in about half the soils examined, but in some cases it was decreased, while the solubility of iron was decreased in most cases.

Heating to 250° C. or ignition produced effects similar to those brought about at 100° C., but varying in degree, being sometimes greater and sometimes less.

The solubility in nitric acid was not greatly affected by heating to 100° C., but in some instances heating to 250° C. considerably increased the solubility of alumina, manganese, potash and phosphoric acid, and, at the same time, effected a reduction in the solubility of lime and magnesia. Upon ignition, the solubility of alumina, silica, potash, phosphoric acid and sulphates was increased, while the solubility of lime and magnesia underwent a corresponding decrease.

The solubility of the constituents of soils used in aquatic agriculture is abnormally high, but on drying out it becomes more similar to that of aerated soils. When such soils are heated after drying, they seem to undergo changes of the same order as those produced in dry-land soils.

The most important factors affecting the solubility of soil constituents are believed to be of a physical nature, and are attributed to the behaviour of colloidal films adhering to the soil particles. The more important factors of a chemical nature are the deoxidation of manganese dioxide, oxidation (particularly of iron), double decomposition and dehydration. At high temperatures bicarbonates become converted into carbonates, thus effectively lowering the solubility of lime and magnesia.

With regard to the nitrogeneous constituents, nitrates undergo decomposition at 150° C., being practically totally destroyed at 250° C., while ammonia is formed in abnormally large amounts at 200° C. Soil which had been subjected to burning in the field was found to undergo stimulated ammonification after heating. Nitrification on the other hand was not restored after the lapse of two months. Heating to 200° C.

caused a loss of approximately 25 per cent. of the total nitrogen. The loss of nitrogen, and of the ammonia formed by the action of heat, came largely from the monamino-acid group, and to a less extent from the amides and diamino-acids.

316 – **The Rice Soils of Hawaii.** — KELLEY, W. P. in *Hawaii Agricultural Experiment Station, Bulletin* No. 31, pp. 3-23. Washington, D. C., January 1914.

The rice soils of Hawaii are typical laterites, and in mechanical composition resemble clay loams with a rather high organic content. The clay is not composed of kaolin, but consists of ferric and aluminium hydrates with double silicates of iron and aluminium. Chemical analysis shows that they are generally rich in nitrogen and phosphoric acid but poor in potash.

Manurial experiments showed that the best results are obtained by using ammonium sulphate as fertiliser. Organic nitrogenous manures give better results if applied sufficiently early to enable decomposition to begin before planting the rice. Nitrates may produce a decrease in the crop owing to the formation of poisonous nitrites.

Experiments on the rate of ammonification of dried blood in soils of varying moisture content show that it increases steadily with increase in moisture content, reaching a maximum at about two-thirds saturation, after which it declines somewhat; but at complete saturation it is sufficiently rapid to supply the needs of the rice plant.

A rotation of crops whereby a legume is ploughed in between the crops of rice is believed to be the best system for this cultivation.

PERMANENT IMPROVEMENTS DRAINAGE AND IRRIGATION

317 – **Eradicating Water Weeds from Irrigating Ditches.** — *Engineering Record*, Vol. 69, No. 2, p. 40. New York, January 10, 1914.

Disking canals while the water is running is reported as a successful means of eliminating growths of water weeds in the Bear River and Cache valley projects in California. An ordinary disk harrow is stripped of its seat and double trees and the tongue is cut 4 ft. in length. To this are hitched two ropes, leading to teams, one on each bank; by adjusting the length of these ropes the harrow can be run on either slope or on the bottom. This digs up the roots and the plants float down and are removed. The above canals were very foul three years ago when Mr. Whelan, the manager, introduced this system ; now very few weeds are left. It is cheaper than mowing and it does not interrupt the flow of water.

MANURES AND MANURING.

318 – **The Balance of Fertilizers in the Soil.** — HOFFMANN M. Statische Untersuchungen. — *Arbeiten der Deutschen Landwirtschafts-Gesellschaft*, Part 251. Berlin, 1913.

The aim of agricultural statics is to carry out a continued chemical control of the content of plant food in the soil under different rotations, or in other words, statics teach the way of establishing equilibrium between the supply and consumption of plant food in the soil. Its systematic application can be of great assistance in determining the manure requirements of

a soil. Of late years, however, opinions as to the value of statics differ very much, not only among scientists, but also among practical farmers.

In Germany the science of statics has been, and still is, advocated and practised by two eminent practical farmers: Schultz of Lupitz, first president of the section for manures of the Deutsche Landwirtschafts-Gesellschaft, and his successor Vibrans of Calvörde (1). Schultz-Lupitz unfortunately published the balance of five years only (1879-84), while the records of the Calvörde farm embrace a much longer period. Vibrans has, probably more than anybody else, shown great perseverance in the study of the economics of plant food in the soil, for part of his entries reach back to 1868 and are continued most conscientiously up to the present for some fields, especially on sandy or moor soil, so that the material he has accumulated covers a period of upwards of 40 years. These figures have been completely elaborated by the writer of this paper. With the object of verifying the opinions of Schultz and of Vibrans on the value of soil statics, he has added similar figures which he calculated on the data of records of five farms, the working of which was yearly checked by the Book-keeping Office of the Deutsche Landwirtschafts-Gesellschaft. The figures for these farms unfortunately embrace a period of only five years ; 1907-12. It was not possible to establish the statical account for each field as only the totals of the crops were entered. As for the several farms, all the characteristic details that the writer could collect have been described in the text that precedes each table. The figures concerning Herr Vibrans' farm are drawn from his plant-food register.

In the case of Leguminous plants for fodder or pulse the nitrogen was not considered.

These tables afford a comprehensive view of the changes in the amount of plant food in the various fields during the course of years. One of them is reproduced in the accompanying table.

Vibrans has collected similar figures, though partly for shorter periods, for all the fields of his farm.

(1) See *Arbeiten der Deutschen Landwirtschafts-Gesellschaft*, Part 76. Berlin, 1902. (*Ed.*).

Balance of Fertilizers on Calvörde Farm. — Field of 37.7 acre

Year	Applied in manure			Remove		
	K_2O	P_2O_5	N	Crop	Yield	K_2O
1868	94	36	79	Potatoes	11 000	65
1869	—	36	14	Rye	1 390	34
1870	94	36	79	Potatoes	5 350	31
1871	—	36	14	Rye	1 370	34
1872	108	40	94	Potatoes	11 240	65
1873	—	45	14	Rye	1 270	31
1874	—	—	—	Clover and lupins	360	36
1875	140	88	128	Rye	1 400	34
1876	108	40	94	Potatoes	11 060	65
1877	94	47	106	Rye	1 740	45
1878	—	72	—	Peas and clover	2 490	45
1879	—	18	14	Rye	1 740	45
1880	126	43	108	Potatoes	9 460	54
1881	—	54	7	Rye	1 430	36
1882	108	13	54	Potatoes	16 400	108
1883	45	45	13	Rye	1 600	38
1884	140	47	209	Potatoes	17 800	128
1885	45	54	14	Rye	1 250	31
1886	140	47	209	Potatoes	17 800	128
1887	68	65	—	Peas	1 530	36
1888	68	65	—	Rye	1 200	32
1889	113	65	155	Mangolds	26 800	189
1890	113	32	29	Oats	2 500	59
1891	113	32	29	Rye	1 070	29
1892	234	65	79	Mangolds	28 500	202
1893	112	—	29	Oats	660	16
1894	95	36	135	Potatoes	19 300	130
1895	—	32	27	Mangold seed	1 890	40
1896	81	32	—	Rye	1 350	32
1897	135	45	180	Sugar beets	24 600	144
1898	—	32	—	Peas	1 500	36
1899	288	72	234	Potatoes	21 400	162
1900	—	27	13	Mangold seed	1 610	38
1901	72	36	27	Barley	920	22
1902	108	45	108	Potatoes	18 700	142
1903	56	36	31	Barley	1 500	58
1904	108	50	—	Rye	1 160	31
1905	83	97	29	Rye	1 600	41
1906	76	56	56	Rye	1 470	45
1907	76	54	54	Rye	1 530	47
1908	126	54	56	Rye	1 710	45
1909	81	59	40	Rye	1 430	54
1910	180	94	94	Mangolds	28 500	180
1911	72	49	61	Rye	890	22
1912	—	—	27	Rye	1 360	34
In 45 years: total	3700	2027	2743			2010
In 45 years: as dung	1906	673	1968			
In 45 years: as chemicals	1794	1354	775			
Yearly: total	82	45	61			65
Yearly: as dung	43	14	43			
Yearly: as chemicals	39	31	18			

drained humous sandy soil. (All figures in lbs. per acre).

crop		Year's balance			Total balance		
P_2O_5	N	K_2O	P_2O_5	N	K_2O	P_2O_5	N
25	72	+ 29	+ 11	+ 7	+ 29	+ 11	+ 7
20	38	— 34	+ 16	— 24	— 5	+ 27	— 17
11	31	+ 63	+ 25	+ 48	+ 58	+ 52	+ 31
20	38	— 34	+ 16	— 24	+ 24	+ 68	+ 7
25	72	+ 43	+ 15	+ 22	+ 67	+ 83	+ 29
18	34	— 31	+ 27	— 20	+ 36	+ 110	+ 9
18	—	— 36	— 18	—	± 0	+ 92	+ 9
20	38	+106	+ 68	+ 96	+ 106	+ 160	+ 99
25	72	+ 43	+ 15	+ 22	+ 149	+ 175	+ 121
27	50	+ 49	+ 20	— 56	+ 198	+ 195	+ 177
25	—	— 45	+ 47	—	+ 153	+ 242	+ 177
25	50	— 45	— 7	— 36	+ 108	+ 235	+ 141
22	61	+ 72	+ 21	+ 47	+ 180	+ 256	+ 188
20	38	— 36	+ 34	— 31	+ 144	+ 290	+ 157
40	112	± 0	— 27	— 58	+ 144	+ 263	+ 99
23	47	+ 7	+ 22	— 34	+ 151	+ 285	+ 65
34	77	+ 12	+ 13	+132	+ 163	+ 298	+ 197
18	36	+ 14	+ 36	— 22	+ 177	+ 334	+ 175
34	61	+ 12	+ 13	+148	+ 189	+ 347	+ 323
22	—	+ 32	+ 43	—	+ 221	+ 390	+ 323
20	40	+ 36	+ 45	— 40	+ 257	+ 435	+ 283
38	88	— 76	+ 27	+ 67	+ 181	+ 462	+ 350
41	81	+ 54	— 9	— 52	+ 235	+ 453	+ 298
14	31	+ 84	+ 18	— 2	+ 319	+ 471	+ 296
41	95	+ 32	+ 24	— 16	+ 351	+ 495	+ 280
9	22	+ 96	— 9	+ 7	+ 447	+ 486	+ 287
34	67	— 35	+ 2	+ 68	+ 412	+ 488	+ 355
18	45	— 40	+ 14	— 18	+ 372	+ 502	+ 337
20	—	+ 49	+ 12	—	+ 421	+ 514	+ 337
32	81	— 9	+ 13	+ 99	+ 412	+ 527	+ 436
22	—	— 36	+ 10	—	+ 376	+ 537	+ 436
43	97	+126	+ 29	+137	+ 502	+ 566	+ 574
22	45	— 38	+ 5	— 32	+ 464	+ 571	+ 541
11	27	+ 50	+ 25	± 0	+ 514	+ 596	+ 541
38	85	— 34	+ 7	+ 23	+ 480	+ 603	+ 564
32	63	— 2	+ 4	— 32	+ 478	+ 607	+ 532
18	36	+ 77	+ 32	— 36	+ 553	+ 639	+ 496
22	47	+ 42	+ 75	— 18	+ 597	+ 714	+ 478
25	50	+ 31	+ 31	+ 6	+ 628	+ 745	+ 484
27	54	+ 29	+ 27	± 0	+ 657	+ 772	+ 484
25	50	+ 81	+ 29	+ 6	+ 738	+ 801	+ 490
29	61	+ 27	+ 30	— 21	+ 765	+ 831	+ 469
49	94	± 0	+ 45	± 0	+ 765	+ 876	+ 469
13	25	+ 50	+ 36	+ 36	+ 815	+ 912	+ 505
20	58	— 34	— 20	— 31	+ 781	+ 892	+ 474
35	2269				+ 781	+ 892	+ 474
25	50				+ 17	+ 20	+ 11

319 – **Manurial Experiments in the German Colonies** (1). — *Reichs-Kolonialamt, Düngungsversuche in dem Deutschen Kolonien*, Nos. 2, 3. II, and 4. Berlin, 1913 and 1914.

The above publications contain the results of further experiments carried out in accordance with the resolution adopted by the Reichstag in April 1911 (2).

Kamerun. — The soils in the mountainous zone — up to the present the only one under cultivation — are of volcanic origin, and therefore of high fertility. This, together with the fact that the native cultivators had never carried on an intensive form of culture, led to the belief that the soils were inexhaustible, which is far from being the case. In fact the high rainfall (10 000-12 000 mm., or 390-470 in.) subjects the soil to serious leaching, which is only partly counterbalanced by the considerable absorbent power of the soils for nutrient materials.

Analyses of the soil do not indicate an especially high nutrient content, which remains within the following limits (per cent.) :

Nitrogen	Potash.	Phos. acid.	Lime	Magnesia
—	—	—	—	—
0.15–0.22	0.05–0.12	0.04–0.145	0.063–0.156	0.08–0.27

Existing plantations cover 70 000 acres, of which 50 000 acres are rubber underplanted with cacao and the rest oil palms.

Nitrogenous manures are hardly needed, as the rapid decomposition of organic matter and the tropical rains, as well as the absorbent power of the soils, tend to maintain the reserves of nitrogen. Potash is required in large dressings, for not only are the soils poor in this substance but the two crops, cacao and palms, remove considerable amounts in the beans and nuts (1.3 per cent. and 0.5 per cent. of potash respectively). The same may be said for phosphoric acid. Lime is especially necessary in tropical agriculture, but must be used with considerable caution as it may otherwise lead to soil exhaustion, and in this connection it may be mentioned that the Kamerun soils, being specially rich in magnesia, should provide good material for investigating the question of Loew's lime-magnesia ratio. Humus is usually deficient in tropical soils and should be increased by the use of all crop refuse and by green manuring.

Fertilizers are beginning to be appreciated by planters, and the imports rose from 22 tons in 1907 to 1450 tons in 1912.

In order to establish a rational system of manuring, the Agricultural Experimental Institute at Victoria has organised a series of manurial trials based on the system adopted by the German Agricultural Society, and modified according to local requirements. Thirty-two series were running in 1911-12 and these were increased to 47 in 1913, embracing the following crops : cacao, Funtumia, Hevea, manihot, oil palm, bananas, tobacco, maize, cotton, earthnuts, sweet potatoes, pine apples.

Togo. — Agriculture being chiefly in the hands of native cultivators, manurial trials have been carried on in their plantations in the hope of

(1) See No. 480, *B.* May 1913; No. 1250, *B.* Nov. 1913; No. 11, *B.* Jan. 1914. (*Ed.*)
(2) See No. 480, *B*, May 1913. (*Ed.*)

eventually inducing them to use fertilizers ; other trials have been carried on too at the Government stations and on private plantations. In 1913, sixty series of trials were running, distributed over the following crops: cotton, maize, sisal, cocoanut, oil palm, cacao, coffee, rubber, kola, sweet potatoes, beans, sorghum, vegetables.

In an appendix the general plan of the experiments is given. Each series consists of five plots receiving so-called " differential " treatment, and is carried out in duplicate. Particulars are also given of the dressings applied to the principal crops, of the area of the plots, and of their treatment.

German East Africa. — From the results of the experiments begun in 1911 (1) it would appear that the application of fertilizers has a good effect on the crops obtained, but more data are required to confirm these results. The plan originally laid down for the experiments has proved very satisfactory and has not required to be modified in any way, but a larger staff is urgently required in order to carry on the work more effectually.

German New Guinea. — Notwithstanding their origin from recent volcanic material, the soils exhibit a relatively low potash content, from which it would appear that there must exist a factor impoverishing the soils in this respect ; phosphoric acid is high and nitrogen rather low. In 1912 there were 80 000 acres under cultivation in the Protectorate (including the islands); of this area, 73 000 acres were under coconuts, 26 700 acres being in bearing. Other plantations consist of rubber and cacao, and the starch-producing plants of the natives, the latter being very exhausting crops. Coconuts too, remove large quantities of mineral matter from the soil : with 40 palms to the acre, an annual production of 2400 coconuts per acre would remove :

potash	71 lbs.
nitrogen	11 »
phosphoric acid	6 »
lime	6 »
magnesia	4 »

Up to the present manuring has been confined to the application of dung or to green manuring with *Crotalaria striata, Tephrosia purpurea* or other Leguminous plants, but more complete manuring is necessary not only for increasing the crops but also for making them more resistant to desease. The extended use of fertilizers will, however, be impeded by the high cost of transport.

The Government started 32 series of trials in 1912-13 and increased them to 35 for the season 1913-14, distributed over the following crops: coconuts, rubber, cacao, coffee, bananas, maize, sorghum, sweet potatoes, manioc, earthnuts, castor oil, *Paspalum dilatatum*, pineapples and vege-

(1) See No. 480 *B.* May 1913. (*Ed.*).

tables. The experiments were carried out on the same lines as those mentioned above in connection with Togo.

Samoa. — The soils are of variable fertility, notwithstanding their common basaltic origin, and, according to the analyses of Woltmann, possess a high content of nitrogen, phosphoric acid, magnesia and iron and a moderate to low content of lime, but are deficient in potash.

Twenty-three series of manurial trials were started in 1912-13 and increased to 32 the next season ; they deal with the following crops : cacao, coconuts, rubber, taro, lucerne, pasture, bananas, maize, tobacco, pineapples, vegetables.

The first experimental results obtained with taro (*Colocasia antiquorum*) are of special interest, as it is the chief native crop and the principal article of diet of the Samoans. Being an exhausting crop the native practice is to move on to a fresh piece of ground when the soil is worn out. With the usual manurial dressings, it was found that, though the experimental plots had previously been under cacao, crops of tubers were obtained equal to those on virgin land. Moreover the formation of new tubers was greatly stimulated, and the number of new shoots formed averaged ten per plant or twice the usual number, so that not only was the harvest larger but the means of propagation were also increased. The new tubers were almost as large as the mature tubers, which is not usually the case, and their shoots were so well developed that they could be transplanted without experiencing a set back. The new tubers being more abundant, five could be left in the soil in the place of the usual two, and thus the crop was increased.

An appendix to this report contains detailed instructions for carrying out the experiments as well as the arrangement of a book for recording results.

320 – **The Influence of Catalytic Substances on Crop Yields.** — RIVIÈRE, G. and BAILHACHE, G. in *Journal de la Société Nationale d'Horticulture de France*, Vol. XIV, pp. 782-788. Paris, December 1913.

In 1906, applications of ammonium vanadate, sodium borate, sodium fluorate, and sodium arsenate increased cereal crops 10 per cent., while salts of lithium, caesium and rubidium had a still greater effect on a beet crop. During the next three years, rubidium salts alone were tested, and in two out of the three years marked increases in the yields were obtained. The soil on which the experiments were carried out was a loam resting on clay.

321 – **Phosphate Beds in Egypt.** (1) (Note sur l'industrie minière en Egypte, rédigée par le Département des Mines-Phosphates). — EGYPTE, MINISTÈRE DES FINANCES, *Annuaire Statistique de l'Egypte*, Year V, p. 583. Cairo, 1913.

The Egyptian phosphate beds are very similar to those of Tunis and Algeria, being widely distributed and forming altogether a very large area. They have been comparatively little investigated. As they are situated

(1) See No. 1246, *B.* Nov. 1913.

a long way from the Mediterranean coast, those nearest to the other transport routes were the first to attact attention, and the ones being worked at present are near either the Red Sea or the Nile Valley. These too, according to the available evidence, are the richest, and compare favourably with Tunisian and Algerian varieties. It is thought that it will be possible to increase the production of the richer salts containing 68 per cent. or more of tricalcic phosphate and that the material will be exported to Europe. The entire production of the " Egyptian Phosphate Co." for 1912 (60 000 tons) was sent to Japan ; this company works three mines near Safaja Bay (Red Sea), where modern appliances have been erected for loading, and a light railway has been laid to connect the mines with the port. The " Società Egiziana per l'Estrazione ed il Commercio dei Fosfati " is also working large areas at El-Kosseir on the Red Sea and at Sebaia on the Nile and is erecting plant for export work.

Should the demand for phosphates be maintained, as there is every reason to suppose from their increasing use, the future of the Egyptian industry is very promising.

322 – **Influence of Radio-active Emanations on Vegetation.** — STOKLASA, J. and ZDOBNICKY, V. in *Comptes Rendus hebdomadaires des Séances de l'Académie des Sciences*, Vol. 157, No. 22, pp. 1082-1084. Paris, December 1, 1913.

AGRICULTURAL. BOTANY. CHEMISTRY AND PHYSIOLOGY OF PLANTS.

1. — *Cultures in Knop's solution containing radio-active water either artificial or natural.*

The experiments were conducted at Franzensbad and Brambach near the sources of the natural waters. The Brambach waters possess a strength of 2200 Mach units per litre, and those of Franzensbad about 100 to 150 units. Each culture was supplied with 70 Mach units of radio-activity in its nutritive solution. After two days, the activity of the solution had been reduced to 52 units, after three days to 36 units, while after four days it fell to only 19 units and had to be renewed. During the 23 days of the experiment, each plant had received 350 units of radio-activity.

After 23 days at a temperature of 18° to 20° C. the following results of the dry weight of the plants were obtained :

	Control	Radio-active
Lentils	3.7 grams	6 grams
Peas	9.7 »	21 »
Wheat	3.1 »	8 »

Thus the radio-active water has increased the yields by from 62 to 164 per cent.

The following results were obtained with buckwheat grown in soil for 32 days and supplied with solutions containing 30 and 60 units of radio-activity every five days:

	Dry weight of 100 plants
Control	9.45 gms.
With 30 units	13.54 »
With 60 units	19.54 »

When the radio-activity was increased by giving 600 units every four days, the growth of the plants was checked.

2. — *Pot cultures sprayed with artificial radio-active water.*

Experiments with poppies (35 plants) receiving a total of 2500 units of radio-activity during a period of 108 days, gave the following results :

	Dry matter		
	fruits	stems	total
	—	—	—
With radio activity	35.33 gms.	83.58 gms.	118.91 gms.
Control	16.25 »	63.08 »	79.33 »
Increase due to radio-activity	19.08 » or 117.4 %	20.50 » or 32.4 %	39.58 »

Lupins (48 plants) sprayed with water containing a total of 2000 units gave the following results :

	Dry matter		
	seeds.	stems.	total
	—	—	—
With radio-activity	224.91 gms.	451.25 gms.	676.16 gms.
Control.	136.58 »	284.16 »	420.74 »
Increase due to radio-activity	88.33 » 65 %	167.09 » 59 %.	255.42 »

Thus spraying the plants with radio-active water increases the fertility and the rate of maturity of the plants.

3. — *Pot cultures subjeted to radio-active emanations in closed vessels of 85 litres capacity.*

Experiments with field peas, maize, buckwheat, white mustard and beets, grown in air charged with from 10 to 30 Mach units per litre, showed earlier flowering and more rapid maturity and increases in yield of from 30 to 90 per cent over those of the control plants.

Large doses of radio-active emanations retard growth and appear to give rise to toxic products.

PLANT BREEDING.

323 – **Royal Hungarian Institute for Plant Breeding** – *Communication from* M. EMILE GRABNER, *Chief of the Institute.*

The improvement of agricultural plants in Hungary has been practised for a considerable time, but owing to the faulty system followed, positive results have ouly been obtained during the last 10 years by the adoption of systematic selection. Owing to the continental climate, it is not possible to acclimatise the most important varieties of crops (especially wheat) produced in Western Europe, and it therefore becomes more necessary in the interests of intensive culture to adopt measures for the improvement of local varieties. Various isolated attempts had already been made in this direction, and the necessity for coordination called for the creation of a State Station to render assistance to workers by means of professional advice, to reorganise and develop the methods of improvement and to take up the improvement of the more important plants not selected by the agriculturists.

With this object in view, the Ministry of Agriculture established the Royal Hungarian Institute for Plant Breeding. The work of organisation was begun in the spring of 1909 at Budapest and continued the following year at Magyaróvár, where the station was finally set up at a cost of £13 300 for the land and buildings and £ 3 300 for equipment. The garden covers nearly 2 acres and is close to the central building containing the offices and laboratories. There is also a glass culture house for tender plants, 200 portable culture pots and 140 pots sunk in the ground. The garden is used for the more valuable culture material under investigation, such as the first year's selection and hybrids. About 15 minutes' walk from the town, there are about 50 acres of experimental fields for the trial of selected seeds and the multiplication of desired strains for adoption on a large scale. There is also a building containing a museum for the classification of products, a seed depôt and rooms for the overseer. The staff of the Institute includes the chief, 4 assistants, 1 chemist and 1 clerk, under the direct charge of the Ministry of Agriculture.

Some idea of the recent work of the Institute can be obtained from the following figures showing the material under investigation:

Wheat	3708 plots	883 plots of pedigree wheat from workers in different parts of the country.
		1758 plots of F_3 generations.
		128 » » F_2 »
		256 » » F_1 »
		683 » for the trial of foreign varieties

Rye	1997	plots selected from different varieties.
Barley	179	» of selected strains.
Oats	620	»
Maize	75	»
Potatoes	410	» of hybrids.
Lucerne and clover .	2263	» of selected strains.

By means of gratuitous advice to practical agriculturists on the carrying out of selection methods and local selection experiments, the Institute is organised so as to meet the requirements of the different districts by producing varieties adapted to the various climatic and soil conditions. The best types thus obtained by practical workers are tested in the experimental fields of the Institute, subjected to rigorous investigation and finally used for hybridisation work. This intimate collaboration with the practical agriculturists in the different districts promotes the success of the work of the Institute and the adoption of its methods throughout the country. Questions affecting the theory of selection and the improvement of plants (clover and lucerne) not undertaken by the practical agriculturists are under investigation in the experimental fields of the Institute, and any results obtained will be immediately adapted to the climatic conditions of the different districts.

The work of the Institute may be summarised as follows : 1) extending its sphere of activity thoroughout the entire country and securing the adoption of its methods by the practical agriculturists ; 2) directing local work among the agriculturists ; 3) researches on the theory of selection ; 4) making known the principles of selection by means of publications and lectures ; 5) selection of plants not undertaken by practical agriculturists.

Tobacco, flax and hemp are not included in the programme of the Institute, a separate experimental station being devoted to each of them. The selection work is chiefly concerned with the chief crop plants. The accompanying list gives the distribution of the different crops in percentages of the total cultivated area (excluding Croatia-Slavonia), which has varied during the last five years between 31 and 32 million acres.

Wheat, autumn	27.49	to	30.45
» spring	0.88	»	1.07
Maize	20.42	»	21.71
Oats	9.15	»	9.56
Barley, spring	8.72	»	9.63
» autumn	0.48	»	0.58
Rye, autumn	8.61	»	9.20
» spring	0.17	»	0.24
Potatoes	4.97	»	5.28
Lucerne, clover	4.49	»	4.98
Mixture of vetches, moha (*Panicum germanicum*) and other forage plants	3.78	»	4.16
Sugar-beets	0.90	»	0.99
Mangels	1.62	»	1.73
Other plants (e. g. sorghum)	1.08	»	1.15
Maize (forage)	0.78	»	0.89
Meslin (wheat and rye)	0.48	»	0.62
Hemp	0.46	»	0.49
Flax	0.07	»	0.11
Tabacco	0.42	»	0.44
Vetches	0.37	»	0.41
Pulse (peas, lentils, beans)	0.25	»	0.28
Colza	0.14	»	0.24
Millet	0.18	»	0.25
Buckwheat	0.03	»	0.05

The Institute occupies itself, in the first place, with the different cereals, potatoes, sugar-beets, mangels, lucerne and clover, and only undertakes the improvement of other crops when their development requires it. Owing to its very recent organisation it is not able to show results in all the branches of its activity. Several years before the creation of the Institute the present chief began operations in the selection of wheat, which have been continued now for eight years in various districts. As a result of this selection we have already obtained selected strains of wheat derived from common Hungarian wheat by rational methods of selection; which have given increased yields of 7 ½ to 9 bushels per acre in the field trials

during the last three years. The experiments on the selection of other plants, though at present in the early stages, give promise of equally good result, and we have reason to expect that the Institute will realise in the near future the task which it has undertaken, *i. e.* to increase the productiveness of the country by the creation of more productive varieties suitable to the climate and soil conditions. In direct relation to the practical problems, scientific reseaches concerning the reorganisation and development of the methods of selection are in course of progress, and good results are expected from them.

324 – **Studies on Variation and Selection.** — HAGEDOORN, A. L. and Mrs. A. C. in *Zeitschrift für Induktive Abstammungs- und Vererbungslehre*, Vol. II, No. 3, pp. 145-183 + 4 figs. Berlin, January 1914.

This is a survey of the progress made in the Mendelian interpretation of variation and selection. The difficulties of the present terminology are pointed out and a plea is made for more precise definition and use of terms. The criticisms of the zoologists are analysed and answered by results from the writers' own experiments.

325 – **The Preservation of Pollen.** — ROEMER, TH. in *Zeitschrift für Pflanzenzüchtung*, Vol. II, Part 1, pp. 83-86. Berlin, January 1913.

The writer has established by experiments that the pollen used for artificial fertilization preserves its power of germination best when kept at a low temperature and in the driest air.

326 – **Variation in the Hereditary Value of Chasacters in Individual Flowers of *Pisum sativum*.** — ZEDERBAUER E. In *Zeitschrift für Pflanzenzüchtung*, Vol. II, Part 1, pp. 1-26. Berlin, January 1914.

The writer had for some years observed that in the splitting up of the seed-characters in the F_2 generation of crosses of certain peas, there was a difference according to the position on the plants, as for instance that the lowest pods gave yellow seeds, while green ones began to appear in the middle pods and were more numerous in the highest ones. This led him to make a careful examination of the results obtained by crossing the flowers occurring in different positions on the plants.

The parents used were Wunder von Amerika (green wrinkled seeds) and Auslös de Grâce (yellow smooth seeds) ; these varieties agree in being 8 to 12 inches high and in bearing the first flower in the axil of the seventh or eighth leaf. For these varieties the 1st and 2nd flowers are reckoned as early, the 3rd to 4th or 5th as middle and the remaineder as late.

Crosses between flowers of the same period (*e. g.* early × early) are called *isochronous*, and those between flowers of different periods (*e. g.* early × late) *heterochronous*.

Table I gives a summary of the results (F_1 generation seeds) from the crossing of a large number of flowers on ten plants, in which the female parent (M) was Wunder von Amerika and the male parent (P) Auslös de Grâce : the yellow and smooth characters of the latter are dominant. On every plant one or more flowers were selfed as a test of purity and all gave unmixed wrinkled green seeds.

TABLE I.

M No. of flower	P No. of flower	yellow	yellow, tinged green	yellowish green	green	smooth	slightly wrinkled	wrinkled
			a) *isochronous crosses.*					
1	1	—	—	8	16	8	—	16
2	2	—	1	15	1	16	—	1
3	3	—	—	12	1	12	—	1
4	4	—	3	12	1	11	4	1
5	5	—	1	—	1	1	—	1
Total per cent.		—	7	65	28	67	5	28
			b) *heterochronous crosses.*					
			1) middle M by early P.					
3	1	—	4	1	—	5	—	—
2	1	—	1	1	2	2	—	2
Total per cent.		—	56	22	22	78	—	22
			2) late M by early P.					
5	1	—	11	4	—	14	1	—
6	1	—	7	1	—	5	3	—
6	2	2	1	1	—	2	2	—
7	1	1	2	—	—	—	3	—
Total per cent.		10	70	20	—	70	30	—
			3) early P by M of various ages (in per cent.).					
1	1	—	—	33	67	33	—	67
2	1	—	—	80	20	70	10	20
3	1	—	80	20	—	100	—	—
4	1	—	25	25	50	50	—	50
5	1	—	73	27	—	93	7	—
6	1	—	86	14	—	63	37	—
7	1	33	67	—	—	—	100	—

A second series was carried out with the reciprocal cross. Here the isochronous crosses gave 16 per cent. yellow, 52 per cent. yellow tinged with green and 32 per cent. yellowish green (no green), and 100 per cent. smooth; heterochronous crosses gave for M1 × P6, 19 per cent. yellow and 81 per cent. yellow tinged with green, and for M6 × P1, 100 per cent. yellowish green.

In discussing these results, the writer suggests using the term "valency" for the power of transmission of a character: thus dominant becomes prevalent and recessive sub-valent, while equi-valent is used for cases in which

the F_1, characters are intermediate; these terms refer to valency in space Räumliche Wertigkeit). The valency is modified by the period of opening of the flower: thus the early flowers have high valency the middle ones moderate valency, and the late ones low valency, these terms referring to valency in time (Zeitliche Wertigkeit). The valency of the character further varies with the sex to which it is attached, being higher in the female.

A hypothetical scheme may be drawn up for the valency (Wertigkeit) of the different characters in the flowers of the different periods (when yellow is associated with the female parent):

Valency of yellow, (M) in	early flowers (I)	24
	middle » (II)	18
	late » (III)	12
Valency of green (P) in	early flowers (I)	20
	middle » (II)	15
	late » (III)	10

Thus M (II) 18 × P (I) 20 will give preponderance of P, M (II) 18 × P (II) 15 preponderance of M, and M (II) 18 × P (III) 10 preponderance of M (probably unmixed M).

In the case of smooth and wrinkled, the valency of the former character appears to be higher relatively to the latter (*e. g.* 35 : 20) than in the colour pair (24 : 20), as it is not till M (III) × P (I) that mixing occurs (where smooth is associated with the female parent).

327 – **On Differential Mortality with respect to Seed Weight occurring in Field Cultures of *Pisum sativum*.** — HARRIS, J. A. in *The American Naturalist*, Vol. XLVIII, No. 566, pp. 83-86. New York, February 1914.

It has previously been shown (1) that the mortality of seeds of *Phaseolus vulgaris* before germination is not random but differential or selective.

In these experiments with *Pisum sativum*, about 1000 seeds from each of ten commercial early (dwarf) varieties were weighed, individually labelled and planted in short rows in the experimental field. The weight distributions were based on differences of 0.025 gram, and the mean weights and coefficients of variability were calculated from the variates thus obtained. When the plants had grown about 3 in. high, counts were made of the seeds which had failed to germinate.

In seven varieties it was found that the mean weight of the seeds which had germinated was greater than the mean of the ungerminated seeds. In the remaining three varieties the mean weight was greater in the ungerminated seeds, the differences between the means being 2.2, 3.9 and 5.5 times their probable errors respectively. In at least one case, therefore, there is a tendency for the lighter seeds to show a viability greater than that of the heavier seeds.

Comparison of the standard deviations and coefficients of variability of the ten varieties shows that the variation of seed weight is less in the seeds of greater viability in 7 cases, but these are not the same varieties in which the mean weight was greater.

These results are therefore in agreement with those obtained in the case of *Phaseolus*.

(1) See No. 110, *B.* Feb. 1914. (*Ed.*).

328 – A Genetic Analysis of the Changes produced by Selection in Experiments with Tobacco. — EAST, E. M. and HAYES, H. K. in *The American Naturalist*. Vol XLVIII No. 565, pp. 5-48 + 9 figs. New York, January 1914.

These experiments were designed with a view to testing the theory of Johannsen regarding the finality of selection of pure lines, and to show that the changes which follow the continuous selection of extremes under certain conditions are to be interpreted entirely by the segregation and recombination of hypothetical gametic factors which are constant in their reactions under identical conditions.

Nicotiana tabacum was chosen as being easily grown, naturally self-fertilised, and prolific in seed production, that is to say ideal for the purpose. Number of leaves was the character studied, since it is unaffected by environment (except during the critical period of development in the embryo). The parental cross was made between the Havana variety having a range of 16 to 25 leaves and an average of 20, and the Sumatra variety with a range of 21 to 32 leaves and an average of 26. The results of this cross are set out below :

	Sumatra × Havana
No. of leaves	21 – 32 | 16 – 25
Coeff. of variability	6.64 ± 0.27 % | 6,98 ± 0.27 %
	F_1
No. of leaves (average)	23.3 ± 0.14 %
Coeff. de variability	6.24 ± 0.41 %
	F_2
No. of leaves	18 – 31
Coeff. de variability	10.29 ± 0.23 %

Thus the F_1 generation is intermediate between the parents and has practically the same coefficient of variability. The F_2 generation was extremely variable and included both the parental types. Some combined the leaf size and habit of growth of the Havana parent with the leaf number of the Sumatra parent, and therefore resembled the type obtained by Shamel in 1906 in the F_3 generation of the reciprocal cross between these two varieties. This hybrid, known as Halladay, had 26 small round-pointed leaves with short internodes, and was supposed to be a mutation. In 1908 100 seed plants of this hybrid were selfed, and produced the material used in these selection experiments. Accurate observations of the progeny of these F_3 and F_4 plants showed that their homozygosity was only apparent. The general type of the plants appeared to be constant, but the frequency distribution for number of leaves was not the same in the F_4 and F_6 populations.

Selection was made of the extremes in these generations with the following results :

Generation	No. of leaves of parent	Range of no. of leaves	Mean	Mode
F_4	—	—		25
F_5	—	—		23
F_6	23	20 to 27	22.4 ± 0.11	22
F_7	20	17 to 28	21.9 ± 0.08	21
	27	20 to 32	24.9 ± 0.11	25
F_8	20	18 to 26	21.3 ± 0.05	21
	30	22 to 33	26.6 ± 0.07	26
F_9	20	14 to 25	18.4 ± 0.07	18

The extremes selected for the parent plants were not members of the most extreme classes, yet selection of the minus variants reduced the mode from 23 to 18 and selection of the plus variants raised the mode from 23 to 26.

In a duplicate set of experiments at New Haven, Connecticut, selection of the minus variants reduced the mode in three generations from 23 to 21 and the plus selections increased the mode to 28. In the F_9 generation there was a difference of 9 between the means of the two strains.

The results of selection in other strains did not give such regular changes in the modes of each generation, and, in some of them selection produced no change at all. This is what would be expected in strains of different degrees of heterozygosity.

In one particular strain, selection of the minus variants produced practically no change in the mode in three sets of experiments, while selection of the plus variants raised the mean to 30.7, 29.6, 30.8 in the three corresponding plus strains. In these experiments at Bloomfield, the F_8 generation from the plus extreme showed a remarkable range of variation, from 18 to 36.

In another strain, selection of both extremes resulted in a slight increase in the mean during three generations, and, in the F_7 generation of the plus strain having a mean of 25.7 ± 0.09, a 12-leaved plant appeared. An individual with 12 leave shad never been observed before, though thousands of plants have been examined. The distribution of plants in this generation was as follows:

No. of leaves	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
Frequency	—	—	1	—	—	—	—	—	—	—	1	1	4	24	36	42	44	41	21	13	7	—	—	—

This 12-leaved plant was selfed and gave rise to a population giving the following analysis.

Generation	No. of leaves of parent	Range of no. of leaves	Mean
F_6	28	(12) 20 to 30	25.7 ± 0.09
F_7	12	8 to 30	19.8 ± 0.28
F_8	10	11 to 27	17.9 ± 0.08

Evidently a mutation occurred in the F_6 generation and this mutant did not breed true as in the case of those of De Vries.

Conclusions.

The results show that the Halladay hybrid originated in the segregation and recombination of the characters of the parents (Havana and Sumatra) and not as a mutation. The fact that strains were obtained from this hybrid with a greater mean number of leaves than even the Sumatra parent shows that the difference between the parent varieties in leaf number is greater factorially than somatically. The original hybrid, which was supposed to breed true, gave rise to plus and minus strains showing progressive changes on selection, and also to strains which showed no change and appeared to breed true to type; but it is not possible to say that any of the strains are so fixed that no progress could be made by selection. Should a sufficient number of hybrids be obtained, so as to include a perfectly homozygous strain, such type would be found constant for all practical purposes. It may be, however, that long-continued experiment with enormous numbers will show some slight shifting of the mean, and that this may be due to the slow progress of evolution. Such changes could hardly be determined experimentally beyond reasonable doubt.

Mutations may occur due to constitutional changes in a single germ cell, and they therefore appear as F_1 generations giving rise to several new strains requiring selection. Since mutations are not of very frequent occurrence in any particular strain, it is only the comparatively large jumps that are economically important, and these are easily detected without refined methods of procedure. It therefore seems unwise for the practical breeder to expend time and money in obtaining results that are so slow and so trifling that they cannot be detected in carefully planned and accurately executed genetic investigations. The only financially profitable procedure is the isolation of homozygous strains from mixtures of either a mechanical or physiological nature.

Advantage should also be taken of the fluctuating variability which takes place during the critical period of seed formation. Seed from well-developed mother plants will produce plants with a slightly higher leaf number than seed from plants grown under poor conditions. The disturbance due to transplanting, though not affecting the number of leaves produced, affects their development and maturation, and should therefore not be delayed too long.

329 – **Cereals Indigenous to Mongolia.** — PALIBINE, J. W. in *Annalen der Samenprüfungsanstalt am Kaiserlichen Botanischen Garten Peters des Grossen*, Vol. II, No. 1, pp. 1-12 + figs. (summary in French, pp. 13-16). St. Petersbourg, 1914. CEREAL AND PULSE CROPS.

The travels of Mlle. K. W. Jourganoff in N. E. Mongolia during the autumn of 1911 have resulted in the re-discovery of two psammophytic cereals known locally as " khar-soul " and " tsagan-soul " respectively and much appreciated by the Mongols as a source of food.

1. Khar-soul — *Arundo villosa* Trin. (*Calamagrostis villosa* herb. de Trinius) ; *Psamma villosa* Maxim. This was discovered by Prof. Bunge in 1831 and has not yet been entered in the " Index Kewensis " . Specimens exist in the herbarium of the Imperial Botanic Garden of Peter the Great at St. Petersburg, and in the herbarium of G. Potanine. The plant has a horizontal sympodial rhizome producing a series of upright shoots, and is adapted for binding sand dunes. The grains are long and oval in shape with a black pigmented pericarp ; the starch grains are compound like those of oats. Each ear is harvested separately by means of a knife, and the Mongols, who travel on camels, may collect 150 to 180 lbs. of grain each during the season.

2. Tsagan-soul—*Elymus giganteus*, Vahl.; *E. arenarius* L., var. *giganteus* Schmalh. This plant is very similar to *E. arenarius*, but larger in all its dimensions. It occurs in the steppes and sandy places in the south of Russia, near the Caspian sea, in Orenburg and north of the Caucasus, as well as in Turkestan, on the Tian-Schan and in Siberia. The grain is white in colour and is much preferred to khar-soul by the Mongols. The grain of *E. arenarius* L. used to be used for flour in Western Europe in times of scarcity, and is still regularly collected in Iceland, but this grain is much smaller than that of *E. giganteus* Vahl.

These cereals, being adapted to climates with very low rainfall and for binding waste sand dunes, should be of considerable interest for experiment in many parts of the world.

330 – **Contributions to the Question of the Frost-Resistance of Cereals.** — GASSNER, G. and GRIMME, C. IN *Berichte der Deutschen Botanischen Gesellschaft*, Vol. XXXI, Part 8, pp. 507-516. Berlin, 1913.

To extend the work of other investigators, experiments were carried out with grains from very even samples of Petkused winter and spring rye, germinated at 5-6° and at 28° C.; the first leaves were analysed for sugar. Table I gives the results in percentage of dry matter.

Thus the seedlings which had germinated at the lower temperature (and were therefore more frost-resistant) were readily distinguishable from those which had germinated at the higher temperature by their higher sugar-content ; at the same time seedlings of the hardy Petkuser winter rye show a higher sugar-content than those of Petkuser spring rye grown under the same conditions.

Experiments with barley gave corresponding data.

These results indicate that with cereals also the sugar-content has an influence on resistance to cold.

TABLE I.

Series	Germination temperature 5-6°			Germination temperature 28°		
	Total sugar	Reducing sugar	Non-reducing sugar	Total sugar	Reducing sugar	Non-reducing sugar
	Petkuser winter rye					
I	42.19	34.93	7.26	40.92	32.56	8.36
II	43.14	35.86	7.28	39.79	31.14	8.65
III	41.92	34.84	7.08	39.13	31.08	8.05
IV	42.31	35.85	6.46	40.73	33.94	6.79
V	40.97	32.31	8.66	39.52	34.11	5.41
	Petkuser spring rye.					
I	36.58	29.41	7.17	31.57	27.13	4.44
II	37.08	30.57	6.51	33.26	26.58	4.68
III	35.39	30.41	4.98	32.59	26.81	5.78
IV	37.65	31.02	6.63	34.56	30.38	4.18
V	35.85	30.21	5.64	32.94	28.16	4.78

Further experiments, which it was not possible to complete, show that the slighter differences in hardiness among individual varieties of winter grain correspond to slight differences in the sugar-content.

331 – **Environmental Influences on the Physical and Chemical Characteristics of Wheat.** — LE CLERC, J. A. and YODER, P. A. in *The Journal of Agricultural Research*, Vol. I, No. 4, pp. 275-291. Washington, D. C., January 1914.

This paper is a continuation of previous work showing that the composition and physical characteristics of wheat are not to any great extent hereditary.

To distinguish between the effects of the soil and those of climate, samples of soil 5 feet square and 3 feet deep were interchanged among three localities, in Maryland, Kansas and California respectively, possessing widely different climatic conditions.

Four plots were arranged at each station as follows :

1 plot of undisturbed local soil as control.
1 plot of local soil . . . . . } taken up in layers of 3 inches
2 plots of imported soil, one from each station. } to a depth of three feet and replaced in original order.

During 1908 and 1909 Crimean wheat from Kansas was grown on all 12 plots, but as it was found to be unsuitable to the conditions prevailing in Maryland and California, it was replaced by Turkey wheat in 1910, 1911 and 1912.

TABLE I.

Determination		Averages of the three soils		
		California	Kansas	Maryland
Physical properties:				
Water	per cent.	8.98	9.53	9.53
Weight per 1000 grains	grams.	30.2	19.1	25.6
Weight per bushel	lbs.	62.8	57.2	60.1
Plinty grains	per cent.	86	99	35
Chemical analysis on water-free basis:				
Nitrogen	per cent.	2.42	3.30	2.18
Protein (N × 5.7)	»	13.11	18.83	12.43
Alcohol-soluble nitrogen	»	0.92	1.27	0.90
Gliadin in protein	»	41	42	40
Fat	»	1.97	2.	1.94
Fiber	»	2.34	2.89	2.63
Pentosans	»	8.45	8.76	8.56
Sugars	»	3.61	3.32	3.03
Ash	»	1.60	2.30	2.22
Phosphoric acid	»	0.90	1.02	1.18
Potash	»	0.57	0.68	0.67
Phosphoric acid in ash	»	47	45	53
Potash in ash	»	29	30	30

The following determinations were made according to the revised methods of the Bureau of Chemistry:

Water; weight of 1000 grains; weight of a bushel; flinty grains; nitrogen; alcohol-soluble nitrogen; fat; fibre; pentosans; sugars; ash; phosphoric acid; and potash.

The results obtained are summarised in Tables I and II. In Table I they are arranged as averages of the three soils for each district and show the difference due to climatic influence. In Table II they are arranged as averages of the three districts and show the effect of soil conditions.

The results of the undisturbed control plots showed that the disturbance of the soil had not effected the constitution of the plants.

A comparison of the results in Tables I and II shows that only the climatic conditions have any considerable influence upon the properties and composition of the crop.

Considering weight of grain, the figures for weight per 1000 grains show considerable difference in Table II, showing the effect of soil conditions; but these differences are much smaller than those in Table I, showing that the

TABLE II.

Determination	Averages of the three districts		
	California Soil	Kansas Soil	Maryland Soil
Physical properties:			
Water . . . . . per cent.	9.35	9.46	9.29
Weight per 1000 grains . . . . . grams.	26.5	27.9	22.1
Weight per bushel . . . . . lbs.	60.9	60.4	—
Flinty grains . . . . . per cent.	71	69	85
Chemical analysis on water-free basis:			
Nitrogen . . . . . per cent.	2.48	2.52	2.75
Protein (N × 5.7) . . . . . »	13.88	13.94	15.44
Alchol-soluble nitrogen . . . . . »	1.	0.94	1.05
Gliadin in protein . . . . . »	42	41	40
Fat . . . . . »	1.93	1.98	1.97
Fiber . . . . . »	2.55	2.59	2.73
Pentosans . . . . . »	8.41	8.48	8.87
Sugars . . . . . »	3.33	3.48	3.30
Ash . . . . . »	2.13	2.08	2.16
Phosphoric acid . . . . . »	1.04	1.03	1.05
Potash . . . . . »	0.64	0.61	0.66
Phosphoric acid in ash . . . . . »	48	48	48
Potash in ash . . . . . «	30	29	29

climatic effect is much greater than that due to the soil. Similarly, the figures for the flintiness of grain show more variation due to climate than to soil.

With regard to the chemical constituents, the figures for the determinations of nitrogen, protein, ash and phosphoric acid show a much greater variation due to changes of climate than to changes in the soil. Little or no regular variation occurs in the proportions of gliadin, potash in the ash, fat, fibre, pentosans and sugars.

The writer suggests the following possibilities as to the manner in which the climatic factors exert a determining influence on the composition of the wheat crop:

1) Differences in humidity may cause a difference in the transpiration of the plant, which in turn may react on the composition of the crop.

2) Variations in the amount and distribution of sunlight may influence diversely the photosynthesis of the plants.

3) Differences in temperatures and in the succession of hot and cold periods may cause varying vegetative activities in the plants.

4) The climatic differences, such as humidity, rainfall, temperature and sunlight, may bring about changes in the physical chemical, or biological characteristics of the soil, which in turn may react on the crop.

Thus it may not be impossible for soil which has been transferred from one locality to another, to become so changed by climatic environment that the character of the wheat grown thereon would be approximately the same as that grown in soil belonging to the locality.

The great difference between the protein of the Kansas and the Maryland crops cannot be attributed to the greater nitrification in the Maryland soil when transferred to Kansas, since applications of nitrate as fertiliser produce only a slight increase in the protein content of the crop.

The writers consider that these results confirm the conclusion of previous work (1) that environment (climate in particular) rather than heredity is the major factor in determining the physical and chemical characteristics of the wheat crop.

332 – **Some Characteristics of the Endosperm of Chevallier and Goldthorpe Barleys.** — VINE, H. C. A. in *The Journal of the Institute of Brewing*, Vol. XX, No. 1, pp. 23-33 + 2 figs. London, January 1914.

Microscopic examination was made of several verified specimens of Chevallier and Goldthorpe barleys with a view to determining any specific differences in the characters of their starch granules. The author observes that the starch grains from barley, unlike those of the potato which can easily be disintegrated, remain intact after long grinding with the hardest glass, showing that they possess elasticity and resiliency.

In the Goldthorpe varieties the round form of granule predominates, while in the Chevallier varieties the oval form is the general feature. This difference in shape of the grains is only well marked in pedigree strains, and cannot be used to distinguish commercial varieties with reliable results. The ratio of large and small granules is a much more definite criterion, and may prove to be useful in indicating the extent to which any given sample has varied from the true stock. Counts of the numbers of starch granules of different sizes gave the following results :

Size of granules in inches		Percentages of granules:					
		1/1000	3/5000	2/5000	1/5000	1/10 000	1/20 000
	No. of granules counted						
Chevallier	228	0.00	3.70	7.42	3.20	19.20	65.8
Goldthorpe	626	0.47	2.07	2.55	2.07	17.00	76.0
Standwell	445	0.00	2.19	5.06	2.36	14.70	77.0

(1) See LE CLERC, J. A. and LEAVITT, SHERMAN. — *U. S. Dept. Agr., Bur., Chem., Bull.* 128, 1910.

Thus Goldthorpe varieties contain a greater proportion of granules under $\frac{1}{10\,000}$ of an inch.

The effect of climate and soil on the proportions of the grains of different sizes still requires to be worked out.

The cell walls of the endosperm present no features which can be in any way regarded as characteristic of Chevallier and Goldthorpe respectively, although on the whole the laminae of the former are somewhat thinner and more delicate than those of the latter.

333 – **A Drought-resisting Adaptation in Seedlings of Hopi Maize.** — COLLINS, G. N. in *The Journal of Agricultural Research*, Vol. I, No. 4, pp. 293-301 + 4 plates. Washington, D. C., January 1914.

The proper depth at which to plant maize seeds has been the subject of many experiments, but with little consistency in the results. It does not hitherto appear to have been realised that it might be dependent upon a biological factor, definite for each variety or even each individual.

A study of the varieties of maize grown by the Indians in New Mexico and Arizona has brought to light an important adaptative character connected with germination and growth. Studies of seedlings of Hopi maize sown at different depths show that the mesocotyl, *i. e.* the portion of the stem between the cotyledonary sheath and the seed, may frequently develop to a length of 36 cm., and that it may give rise to roots at any point on its surface. Observations of many varieties of maize have shown that it is the elongation of the mesocotyl that enables the shoot to reach the surface, and the maximum extent of elongation is fixed and reasonably constant for each variety.

In the varieties of maize commonly grown the writer has been unable to force the mesocotyl to a length greater than 10 cm., and many seedlings have failed to come up where there was less than 2 cm. between the top of the cotyledonary sheath and the surface of the ground.

In the root system of the Indian varieties there are no secondary seminal roots, the radicle being the only root arising from the seed. These single seminal roots have been traced to a depth of 35 cm., and even further, and are obviously an adaptation to extreme conditions.

The Indians plant these seeds in hills about 20 feet apart, with from 10 to 20 plants in a hill There is no fixed depth for planting, the custom being to plant deep enough to place the seed in moist soil. The plants grow to a height of from 60 to 90 cm., and produce ears near the surface of the ground.

Under irrigation conditions these varieties compare favourably with the more improved eastern varieties in these dry regions ; 36 plants harvested gave 94 ears weighing 37.6 lbs.

The peculiar adaptations of these varieties — a greatly elongated mesocotyl, permitting deep planting and the rapid development of a large single radicle — give them considerable economic importance for the semiarid regions.

334 – **A Cultural Experiment with American and African Dent Corn.** — WACKER in *Fühlings Landwirtschaftliche Zeitung*, Year 63, Part 3, pp. 73-75. Stuttgart, February 1914.

The comparative cultural experiments carried out in the summer of 1913 with Virginian and Natal corn showed that there is little material difference between the two kinds in yield of fodder.

This result agrees with those obtained in the writer's earlier experiments, but is at variance with the results obtained by Stebler and Volkart in 1907-1909 in Switzerland.

335 – **The Physiology of the Germination of Rice.** — AKEMINE, M. in *Fühlings Landwirtschaftliche Zeitung*, Year 63, Part 3, pp. 78-93. Stuttgart, February 1914.

The writer, who, during a series of years, has studied the conditions of germination of rice, summarises the results hitherto obtained as follows :

1) — The maximum, optimum and minimum temperatures for the germination of rice are 40° C., 30 to 35° C. and 10 to 13° C. respectively. From the practical point of view it is important to know that the development of strong seedlings is favoured by warm irrigation water.

2) — Light exerts no influence on the germination of rice.

3) — The same holds true for light of varying refraction.

4) — Rice germinates equally well both in water and in air, when the grains are husked or unhusked, and when the grains are treated with water which contains oxygen or which has been deprived of it by boiling.

5) — The plumule appears sooner if the grain is placed in favourable moisture conditions than in water.

6) — The radicles and crown roots develop considerably sooner in the air than in water.

7) — The stem grows much more rapidly in water than in the air. The opposite is the case with the radicles and crown roots.

8) — The frequent renewal of the water in the experiment had no sensible effect upon the development of the stem or roots.

9) — The same holds true for differences in the depth of water, provided they keep within the limits of 3 to 20 cm. (1.2 to 8 inches).

10) — The suitable degree of moisture for the germination of rice is 60 to 95 per cent. by weight of the seed-bed's capacity for water.

11) — Rice grains are saturated by an amount of water equal to about 25 to 30 per cent. of their air-dry weight.

12) — Rice grains cannot be made to germinate until they have absorbed about 25 per cent. of their air-dry weight of water.

13) — The loss of weight of the unhulled grains during steeping amounts to only 1.5 per cent. of their weight, even after 20 days, if the temperature is 10° to 15° C. (50° to 59° F.).

336 – **The Prevention of Degeneration in Potatoes.** — Communication from the "Saatzuchtstelle der Deutscher Landwirtschafts-Gesellschaft" in *Mitteilungen der Deutschen Landwirtschafts-Gesellschaft*, No. 7, p. 98. Berlin, February 14, 1914. ROOT CROPS

The degeneration of a strain of potatoes originates as a result of any of the diseases which prevent their complete development. Its progress from

one generation to another can be prevented by means of the selection of tubers from well-developed plants marked in the fields during the summer; only such roots should be selected, as come up to the expectation of the previous selection. The tubers of each plant should be grown separately the following year, and the experiment repeated for several years until the desired result has been obtained.

337 – **The Effect of the Weight of Seed Potatoes Upon the Succeeding Crop.** — LYVK, A. v. (Author's abstract) in *Zeitschrift für Pflanzenzüchtung*, Vol. II, Part 1, p. 72. Berlin, 1913.

In 1912, the weight of all the tubers of 24 potato plants was determined ; those which weighed more than 15 grams (in some cases all the tubers of the plant) were planted. The estimation of the weight of the crop when gathered showed that the weight of the seed potatoes exercised a very great influence upon the total crop of the daughter plants. This influence was less noticeable and more inconstant in the case of the bigger tubers, but here also the heavier seed-potatoes produced the larger crops.

338 – **The "Amylometer": a New Apparatus for Estimating the Starch Content of Potatoes.** — MENZEL, V. and STEMPEL, G. in *Zeitschrift für das Landwirtschaftliche Versuchswesen in Österreich*, Year XVI, Part 9, pp. 893-898. Vienna, 1913.

The writer describes a new apparatus by the use of which the starch content of quite a small number of potatoes, and even of a single tuber, can be determined. The apparatus is very useful for breeders who have to deal with a large number of single tubers.

339 – **A Society for Promoting the Cultivation and Economic Utilization of Potatoes (B. V. K.)** *Deutsche Landwirtschaftliche Presse*, Year XLI, No. 3, p. 30. No. 17; p. 210; *Zeitschrift für Spiritusindustrie*, Year XXXVII, No 10, p. 139. Berlin, Jan. 10, Feb. 23 and March 5, 1914.

During the great agricultural week held this year at Berlin, in February, a new society was founded for the promotion of the cultivation of potatoes and the encouragement of their use for various economic purposes.

The society has its seat in Berlin and is based up on the organization of the "Verwertungsverband Deutscher Spiritusfabrickanten", it has been recognized by the three most important societies for the promotion of potato cultivation in Germany, *viz.* the "Verein der Spiritusfabrikanten in Deutschland", the "Verein der Stärke-Interessenten in Deutschland" and the "Verein Deutscher Kartoffeltrockner".

The Society does not wish to promote potato growing at the expense of other crops, but desires to raise the yield per surface unit, which it tries to effect by instituting cultural experiments with different varieties, and by experiments in growing and manuring the crops, etc. It is also anxious, in order to develop the possibilities of utilizing the increased supply (a necessary condition of the attainment of its first aim), to improve the keeping qualities of the tubers by cheaper and better methods of preserving them, and to enlarge the market for fresh and dried products. The Association is endeavouring to centralise all scattered efforts in these directions. The members undertake to preserve a certain portion of their potatoes, the

amount depending on the crop and the condition of the market at the time ; the potatoes are to be ensilaged or dried. It is hoped that by this means a balance will be kept between excessively large and small potato crops, and that the trade will be more regular and the prices steadier.

340 – **Grassland in Britain: Types and their Formation.** — SMITH, W. G. and CRAMPTON, C. B. in *The Journal of Agricultural Science*, Vol. VI, No. 1, pp. 1-17, Fig. 1-4. Cambridge, January, 1914.

In considering grassland from the ecological point of view (soil, climate and topography), the causes leading to its formation may be divided into two groups: 1) natural, and 2) artificial.

Natural grasslands can be separated into two groups, the stable and migratory types ; the latter depend on periodic flooding, flushing and renewal of surface fertility ; these types occur on alluvial and rain-washed or spring-flushed surfaces, along river and coastal belts, and on mountain slopes. The stable types, on the other hand, depend on the nature of the underlying rocks and their physiography, which limit the growth of tree vegetation and prevent infertility due to leaching and stagnancy. Such stable grasslands are found in Britain on : 1) chalk downs, 2) exposed hill and ridges of rocks containing an abundance of lime, such as limestone (including some calcareous or boulder clays, etc), and basic igneous rocks such as the isolated hills of dolerite common in Mid Scotland.

Artificially induced grasslands originated as the result of a widespread demand for pasturage and hay in districts where the natural grasslands are too limited for economic requirements. They usually show marked variations, apparently unconnected with the nature of the habitat, and frequently require constant attention to maintain their grazing value. Sometimes, however, they acquire a certain amount of stability by a process of evolution, following on the destruction of the original vegetation and a phase of tillage. Examples occur in the old established pastures of the midland counties of England.

Owing to the cold temperate climate with moist summers and open winter, grassland is not altitudinally zonal to climate in Britain ; but this climate favours leaching and surface exhaustion in well-drained places, resulting in soil acidity and accumulation of peat, and these are the great physical enemies of grassland in this country. Thus one of the first signs of pasture deterioration in a wet district is the formation of a thick sod of mosses and plant remains, so dense that summer rains cannot penetrate to the soil below ; surface-rooting species (*Agrostis, Anthoxanthum, Luzula*, etc.) then take possession, and deeper rooting species (*e. g.* white clover) dwindle away.

The natural conditions which favour grassland in Britain are therefore those which prevent :

1) leaching of the surface in well-drained positions, leading to competition with heath ; 2) rapid accumulation of raw humus, and competition with moorland species ; 3) stagnancy and souring of the soil in low-lying positions, and competition with marsh ; 4) the growth of forest.

The factors preventing leaching on an elevated or well-drained area are : *a*) a finely divided thin residual soil resting on a soluble or smooth weathering rock basis which constantly supplies mineral nutriment, especially lime ; *b*) periodical flushing of sloping surfaces with waters containing alkaline bases in solution, a natural process corresponding to the artificial top-dressing of basic slag and phosphates. Examples occur on exposed alpine, coastal or moorland slopes.

The factors preventing the souring of the soil and rapid accumulation of raw humus are : *a*) alternate flooding and rapid drainage, *b*) a sufficiency of alkaline bases in solution or in suspension where drainage is less efficient.

The factors which prevent the growth of forest are: *a*) great wind exposure, *e. g.* coastal slopes, coastal plains and plateaux ; *b*) a shallow soil over smooth, unfissured rock in exposed positions allowing no foothold for trees); *c*) a water-table too high, or a roothold too unstable, on wind-swept alluvial surfaces. The establishment of grassland attracts grazing animals which are a most efficient means of suppressing tree seedlings.

Natural grasslands are therefore restricted to :

1) Stable surfaces with a smooth elevated topography and a thin, finely-divided soil supplied with alkaline bases from underlying rocks.

2) Sloping smooth surfaces subject to periodical flushing with mineralised waters.

3) Alluvial surfaces along rivers, periodically flooded and drained.

4) All surfaces favourable for grass roots in places much frequented by grazing animals.

The vegetation of unstable surfaces is rapidly changed in character in places neglected by grazing animals, whereas it may persist and become more extensive if well stocked.

Types of grassland occurring in Britain.

I. *Turf-forming types.* — These are pastures of natural formation and are usually closely cropped and perennially green. Their vegetative growth consists of aerial and subterranean leafy shoots which seldom flower. On stable formations such as chalk downs, ridges and maritime slopes, wiry grasses such as sheep's fescue (*Festuca ovina*) predominate, with scattered, large-rooted procumbent or acauline rosette plants, or trailing small-leaved herbs ; mosses are scarce or absent ; snails, worms, ants and other invertebrates are abundant. The migratory or mat-pastures occurring on flushed slopes consist chiefly of grasses with flat and short leaves, such as *Agrostis* forms, *Anthoxanthum*, *Triodia*, and *Cynosurus*, and others such as *Holcus lanatus* ; sedges of the *Carex panicea* or C. *flava* type occur ; mosses like *Hylocomium squarrosum* or *Hypnum molluscum* are abundant; the invertebrate fauna is less abundant than on the down types ; slugs generally replace snail,dipterous larvae are abundant, while ants are usually absent. The vegetation is often glaucous in tint and unwettable, and contains some rosette-leaved plants with tall flowering shoots.

II. *Meadow types.* — These occur on porous alluvial loams with a high water-table and subjected to flooding, and are characterised by taller herb-

age including grasses of tufted and creeping habit. The grasses of lowland types consist of broad-leaved fescues, *Poa trivialis, Dactylis, Phleum, Alopecurus,* etc.; maritime types have *Hordeum, Phleum, Lolium, Triticum,* etc., and alpine types have alpine forms of *Festuca, Aira, Phleum, Poa,* etc.

III. *Tussock types.* — These occur in many parts of the world on salt-steppes, wind-blown steppes and under conditions of perennial cold or wind. They are composed of coarse, hard or or wiry grasses which tend to accumulate soil by means of stools or tussocks of dead shoots. These types appear to be limited to unstable habitats in Britain, such as waste heaps of mines and quarries, and artificially degenerated moorlands (*Nardus*).

IV. *The Stooled Meadow types.* — These may be considered as exaggerated forms of the tussock type, assuming the stooled habit as an adaptation to gentle flooding and silting. The principal grasses are *Aira coespitosa* and *Molinia coerulea.* Tall rushes and stooled species of Sedge (*e. g. Carex paniculata*) are often present.

V. *Lair grasslands and the Camp-follower types.* — This heterogenous group of grasslands is independent of physiographic and soil conditions. They are of a migratory character and depend on the influence of grazing animals for their formation and persistence. Examples of this type are found in the neighbourhood of shelters and enclosures for sheep and cattle, and near rabbit warrens.

Economic Aspects.

From a consideration of the natural factors which lead to the formation of grasslands, the following deductions may be made :

1. Where these factors are in operation, and stable in character, no artificial interference is necessary to procure good sheep-grazing, and no other treatment than judicious stocking should be attempted until well-established results based on experiment are obtained.

2. Interference with the development of natural migratory grasslands should not be undertaken without a careful consideration in each case of the physiography or " lie of the land ", the nature of the waters and their suspended materials, and the effect of tampering with the drainage. (Thus, while the natural flushing of peaty moorland by water often leads to the appearance of patches of grassland, the conduction of such waters on to the grasslands of the stream alluvia will in most cases promptly lead to marked deterioration in the pasture. Again, the underdraining of sandy loams only accelerates the leaching natural to them, and thus favours heath unless frequent surface manuring with lime or slag is carried on).

3. The grazing and manuring of sheep and cattle on moorlands can do much to establish grassland where migratory geological factors are in operation, but no amount of overstocking will be effective if leaching has reduced fertility and induced acidity.

4. Stability may be acquired by a gradual process of natural selection of those forms of grasses and other plants which are most suited to the treatment in vogue, including grazing. (These differences in the same

species of plants in different fields may account for the differences in the feeding value of pastures having the same botanical analysis).

5. In determining treatment for the improvement of grassland, it seems more probable that careful experiment will lead to better conclusions than botanical analysis alone. An interpretation of results obtained by the application of manures or other treatment in consideration of the physiography, origin and history of the locality, would appear to be the more logical method.

341 – **Rye-Grass and Clover in India.** — BROWN, W. ROBERTSON in *The Agricultural Journal of India*, Vol. IX, Part I, pp. 87-91 + 1 plate. Calcutta, January 1914.

The occurrence of the darnel grass (*Lolium temulentum*) in the wheat fields of the N. W. Frontier Province and Punjab suggested the introduction of Italian rye-grass (*Lolium italicum*) as a forage grass for the cold season.

Experiments with this grass in combination with broad red clover (*T. pratense*), shaftal (*T. resupinatum*), berseem (*T. Alexandrinum*) and lucerne, show that it gives a weight of green fodder equal to the clover-hay crops obtained from the average English rye-grass-clover meadows. Sowings made in August and September on manured and irrigated land enabled three cuttings to be made during the cold season, *viz.* November, February and May.

The local advantages of such a crop are : 1) the cheap rate at which it may be cut by means of a sickle or mower, and 2) a yield of succulent grass when indigenous grasses are not available.

FIBRE CROPS.

342 – **Cotton in Asiatic Russia.** — SCHANTZ, M. — *Beihefte zum Tropenpflanzer*, Vol. XV No. 1, 134 pp. Berlin, February 1914.

This important monograph on the cotton question in Asiatic Russia completes the series of studies on cotton published by the writer.

It begins with an account of the general conditions of agriculture in Turkestan : the dry and distinctly continental climate characterised by considerable variations of temperature (— 44° to + 55° C.), the necessity for irrigation, the very fertile soil, chiefly consisting of loess of Eolian origin.

Varieties. — The most important native varieties are those of Tashkend, Bokhara and Khiva. The latter is more renowned; it yields 26 per cent. of thread with a staple of 20 mm. length. Bokhara cotton has a staple of from 22 to 23 mm. in length, but is coarser.

The native varieties are characterised by the fact that their capsules scarcely open or even remain completely closed at maturity.

The cultivation of American varieties, introduced in 1870, has developed considerably since 1884 ; they now occupy 90 per cent. of the cotton area. American cotton gives a yield of thread of 30 to 35 per cent. and has a length of staple of 29 to 30 mm. The best varieties are King and Triumph. Turkestan cottons of American origin realise the price paid for Orleans-Texas " good middling " quality of 28-29 mm. length.

Commercial qualities. — There are three principal qualities, *viz.* 1) consisting of white fibres, 2) yellow fibres or slightly damaged by the cold, 3) grey fibres, of a deep yellow colour or strongly damaged by cold.

The cotton zone extends from 37° to 45° N., so that itssouthern limit is the northern limit of the American " Cotton belt ".

The cultivation is almost entirely in the hands of natives, whose farms average from 2 to 5 acres and produce 90 per cent. of the total cotton crop.

Cultivation. — The virgin lands are too saline for the direct cultivation of the crop. The preparation of the land consists in the removal of the salt by irrigation and the cultivation of lucerne for several years. No regular rotation is followed; cotton is grown continuously until the yield diminishes, when maize or leguminous crops are grown for several years.

The cultural operations are as follows :

1) Autumn tillage (6 to 8 inches), preceded by irrigation if the land is too hard.

2) Spring cultivation to a depth of 14 inches.

3) Application of fertilisers, chiefly canal mud.

4) Preparation of the beds 28 to 32 inches broad and 10 to 18 inches high. When water is plentiful the furrows between the beds are constructed in a sinuous course so as to decrease the flow of water and obtain a better soaking of the soil.

5) Irrigation, if the soil is too dry for sowing, which is seldom the case.

6) The seeds are dibbled in holes 20 to 28 inches apart. The seeds should be two years old in order to ensure regular germination, and obtained from the first picking. From 20 to 30 seeds are sown in each hole owing to their low germinating power (60 %) and to facilitate the penetration of the surface crust of the soil by the combined efforts of several shoots.

7) Irrigation, singling, weeding. The determination of the correct quantity of water is a very important and delicate problem. In Turkestan too much water is generally given; 3 or 4 irrigations in place of the 10 to 12 are sufficient.

8) Topping of the plants as soon as the flowering reaches a maximum (the first half of July).

9) Picking from the middle of August until October, November and even December, should the weather be suitable.

The Upland cotton is picked as in America. In the case of the native varieties, the entire capsule is picked and the cotton separated after drying. The months of September and October in Turkestan are warm and dry, thus favouring the picking. The stems of the plants are used as fuel.

Pests. — The crop is subject to few insect and fungoid pests in Turkestan. Some regions, such as the Hungry Steppes, have been invaded by flying locusts, but the development of these is checked by irrigation.

Area under cotton and yield. — In 1913 there were 1 127 000 acres of cotton in the four " crown countries " of Turkestan, distributed in the following manner :

Ferghana	729 000
Syr Daria	205 000
Samarkand	79 000
Transcaspia	114 000

The total yield of cotton, including Bokhara and Khiva, increased from 127 000 tons in 1908 to 182 000 tons in 1912-13 distributed as follows:

	Thousands of tons
Ferghana	113
Syr Daria	13
Samarkand	10
Transcaspia	15
Bokhara	21
Khiva	10

The average yield per acre is:

Upland	210 to 235 lbs
Native varieties	170 lbs.

Of the various cotton regions of Turkestan studied by the writer, *Ferghana*, which produces two-thirds of the cotton in Asiatic Russia, deserves special mention. Owing to its situation in a valley sheltered from cold winds, it has a relatively temperate climate. The cultivation is extending rapidly:

1888	91 000 acres
1900	502 000 »
1910	635 000 »
1913	729 000 »

American varieties are almost exclusively cultivated. The cotton is of a beautiful white colour, with silky resistant fibres of 29 to 30 mm. staple. The first quality, comprising 60 to 70 per cent. of the harvest, is classed between " good middling " and " fully middling ".

Rotations:

1. Cotton	8 to 10 years
Sorghum or maize	2 »
2. Cotton	8 to 10 »
Lucerne	5 to 7 »
Sorghum or maize	1 »

Yield. — In 1913 the yield per acre in the district of Andidjan in good estates was about 450 to 550 lbs. for Triumph and 350 to 450 lbs. for King.

Cost of maintenance of one " dessiatine " (2 3/4 acres).

	£	s	d
Manures	2	2	0
Distribution		2	6
3 cultivations	1	18	0
Preparation of beds	1	5	6
Seed		8	0
Sowing		10	0
Singling		9	0
8 irrigations		10	0
Upkeep (weeding, etc)	6	2	0
Picking	1	18	0
Various	1	5	0
Total	£ 16	10	0

343 - **The Cultivation of Paprika Pepper in America.** — YOUNG, T. B. and TRUE, R. H. — *Bulletin of the U. S. Department of Agriculture*, No. 43, 24 pp. + 11 figs. Washington, D. C., December 16, 1913. VARIOUS CROPS

Paprika is a pungent red pepper obtained by grinding the fruits of a Hungarian variety of *Capsicum annuum*. The Spanish variety known as " pimiento " or " pimienton " is distinguished from it by being sweeter and less pungent. The quality of paprika depends on its colour, pungency, swetness and flavour. The colouring matter occurs in the " shell " of the fruit and is preserved in the final product by grinding it with the seeds, which contain an oil in which the colouring matter is soluble. The pungency is due to a crystalline substance known as capsaicin (C_9 H_{14} O_2), found only in the placentae of the pods. The degree of pungency of the product depends therefore on the extent to which the placentae are included in grinding the fruits. Comparative tests of the degree of pungency are made by determining the proportion of finely ground sugar required to be added to cause the pungent taste to just disappear.

Experiments with different samples showed that Hungarian paprika varied in pungency from a ratio of 1 : 300 to 1 : 1360 of paprika : sugar. Home-grown American samples were in general superior to the Hungarian samples ; their degree of pungency varied from a ratio of 1 : 500 in the case of a sample made from the shells alone to 1 : 19000 in the case of a sample made entirely from placentae.

The sweetness of the product is due to the sugar contained in the shells of the pods. Analysis showed that dried shells contained 24.6 per cent. of glucose and 1.7 per cent. of cane sugar. Sun-dried pods from Texas showed only 2.5 per cent. of glucose and 5.9 per cent. of cane sugar.

Cultivation. — As an annual, it is propagated exclusively from seed. The yield of pods is determined by the length of the growing season. In the experimental area in South Carolina the growing period is from 230 to 240 days with a mean summer temperature of 78° F. Abundant sunshine adds brilliancy to the colour and assists in bringing about a uniform ripening of the fruit.

The average yield and profits for four years are given below :

Average yield per acre	Price per pound	Total income per acre	Average cost per acre	Average profit per acre
1092 lbs.	9.3 cents	$ 102.23	$ 31.97	$ 70.26

The items of expenditure in the production of the crop include :

Preparing and sowing the seed bed.
Preparing and cultivating the land.
Transplanting plants to field and resetting to stand.
Fertilisers.
Picking the fruits.
Handling peppers, care of fires during curing, etc.
Fuel (pine wood).
Grading, sacking, handling, etc.

The cultivation of this crop would be profitable under present conditions, but any considerable increase in the supply would reduce the market value of the product.

MARKET GARDENING.

344 – **Ornamental Hibiscus in Hawaii.** — WILCOX, E. V. and HOLT, V. S. in *Hawaii Agricultural Experiment Station, Bulletin*, No. 29, pp. 60 + 16 coloured plates. Honolulu, December 1913.

The writers describe the treatment and propagation of hibiscus, of which about 500 varieties or sub-varieties exist in Hawaii, 240 of them being of some interest.

FRUIT GROWING.

345 – **The Pollination of the Sweet Cherry** (1). — GARDNER, V. R. in *Oregon Agricultural College Experiment Station, Division of Horticulture, Bulletin* No. 116, pp. 3-40. Corvallis, Oregon, August 1913.

Experiments on the pollination of sweet cherries showed that all the varieties tested were self-sterile and that inter-sterility is an important factor determining the success or otherwise of cherry growing.

No evidence has been obtained to show that inter-sterility is correlated with closeness of relationship. The potency of any particular variety of pollen appears to be considerably influenced by environmental factors.

The grafting of inter-fertile varieties is recommended for the improvement of the yield of orchards containing single or inter-sterile varieties. For immediate results, recourse may be had to placing branches of suitable varieties in buckets of water in the orchards during the blossoming period, and the encouragement of beekeeping.

346 – **Frost Protection in the Limoneira Lemon Orchards.** — CULBERTSON, J. D. (Assistant Manager Limoneira Company) in *Monthly Bulletin of State Commission of Horticulture*, Vol. III, No. 1, pp. 1-8. Sacramento, Cal., January 1914.

Experiments have been carried out in the lemon orchards of the Limoneira Company, Santa Paula, California, on the use of coal and oil fuels, as a means of preventing frost injury.

Oil gave the best results as regards both efficiency and cost of labour. Though the fruit was badly sooted, the trouble of washing with cheap kerosene and soap wash was more than compensated by the success of the crop. Each tree was protected by an oil pot, and the temperatures in different parts of the orchard were recorded at the central station by means of a telephone system. The best type of oil pot was found to be one fitted with a "down-draught" tube, either perforated or slit, so as to maintain an ample supply of air at the surface of the burning oil.

(1) See also No. 133, *B.* Feb. 1914. (*Ed*).

Cost and maintenance of equipment for an orchard of 500 acres.

	$
50 000 oil pots	50 000
2 steel storage tanks of 5 000 barrels capacity	4 885.89
2 cement reservoirs of 100 000 gallons capacity, equipped with pump.	3 000
5 miles of 3 inch and 4 inch pipe line	6 375.03
35 tank wagons and tanks	4 315.00
150 spout pails for filling pots	300
200 torches	200
50 thermometers	150
4 miles of telephone system	750
350 000 gallons of oil in orchard at 2 1/2 cent	8 750
500 000 gallons of oil in storage at 2 1/8 cents	12 500
Total investment for 500 acres	$91 225.92

The annual interest, deterioration, and maintenance expense per acre, excluding cost of operating, is as follows:

	$
6 % interest on total investment	10.94
15 % deterioration on on $ 100 worth of pots	15.00
6 % deterioration on balance of equipment	2.40
Estimated maintenance: handling, painting, filling	5.00
Total	$33.34

The writer points out that the danger of a deficit is far more serious than a possible lessening of profits in attempting citrus growing in cold areas.

347 – **A Trial of Orange Stocks at Peshawar.** (N. W. Frontier Province, India). — BROWN, W. R. in *The Agricultural Journal of India*, Vol. IX, Part I, pp. 84-86 + 4 plates. Calcutta, January 1914.

Four different varieties of citrus are used as stocks for budding the Malta and Sangtara oranges north of Delhi, *viz*: 1) the "mitha" or sweet lime, said to produce sweet thin-skinned fruit; 2) the "khatti" or small sour lime, on account of its vigour; 3) the "khatta" or large sour lime, and 4) the "gulgul" or coarse citron, for inducing early growth and maturity.

Experiments at Peshawar showed that Maltas grow best on the "khatti" stock, while Sangtaras are more successful on the "mitha" or "gulgul" stocks. Further experiments are required to determine the best stocks for other localities, and for developing such characters as flavour, thinness of skin, date of ripening, early fruitfulness, length of days and power to withstand excessive irrigation.

348 – **Chestnut Hybrids in America.** — VAN FLEET, W. in *The Journal of Heredity*, Vol. V, No. 1, pp. 19-25 + 5 plates. Washington, D. C., January 1914.

Since 1894 numerous crosses have been made between Asiatic, European and American species of chestnut. All hybrids derived from

Castanea americana were found susceptible to the destructive bark disease *Endothia parasitica.*

The most promising results have been obtained in crosses between the American chinquapin (*C. pumila*) and the Japanese chestnut (*C. crenata*). These hybrids form vigorous, small, much-branched trees, rarely shrubs, and come into bearing at from 3 to 5 years old. They bloom profusely and the burs are borne in clusters or racemes of 3 to 5 or more, containing nuts intermediate in size between those of the parents. The nuts have none of the starchy and tannin-like flavours so common with European and Asiatic chestnuts, but are not so sweet as the wild chinquapin.

The disease-resistance and early fruiting of these hybrids gives them great promise from a horticultural point of view.

LIVE STOCK AND BREEDING.

HYGIENE

349 – **Effect of Smoke on Stock Farming.** — *The Journal of the Board of Agriculture*, Vol. XX, No. 10, pp. 896-898. London, January 1914.

In connection with the investigations being carried on at Leeds University on the effect of atmospheric impurities on vegetation, an enquiry was addressed to the farmers of the district with regard to the effect of town smoke on stock farming. The results show that a polluted atmosphere is deleterious to both cattle and horses; young stock do not thrive, and adult stock require more food and greater care than similar animals in a less contaminated atmosphere, the ill effects being due partly to the direct respiration of the smoke-laden air, and partly to the effects of the smoke on the grass. Sheep are rarely seen in these districts, as, in addition to the difficulties of rearing and fattening stock, the depreciation in the market value of the animals as a result of the blackening of the wool by smoke has to be taken into account.

The harmful effect of a smoky atmosphere seems to be cumulative from generation to generation.

350 – **A Preliminary Report on the Investigations of Bovine Red Water (Cystic Hematuria) in Washington.** — KALKUS, J. W. — *State College of Washington, Division of Veterinary Science, Bulletin* No. 112, pp. 1-27. Pullman, Washington, October 1913.

Cystic Hematuria is a local disease prevalent amongst dairy cows in the western part of Washington State, especially on rough, hilly ground. It is sporadic and characterised by a constant or periodic discharge of blood in the urine and by vascular lesions on the mucous of the bladder. Blood from an affected animal produced no ill effects when injected into a healthy animal, but the disease was transmitted by inoculation with the bladder lesions, though no causative organism has so far been isolated. The disease is chronic; some drugs seem to afford temporary relief, but affected cows usually succumb eventually.

351 – **Comparative Histology of Alfalfa and Clovers.** — WINTON, K. B. in *The Botanical Gazette*, Vol. LVII, No. 1, pp. 53-63, + 8 figs. Chicago, Ill., January 1914. FEEDS AND FEEDING

Owing to the growing importance of alfalfa and clovers as feeding stuffs and their suitability for grinding into meal, a means for their microscopic identification is required.

The highest feeding value of the hay or meal is obtained from plants cut early in flower, though more or less mature fruits and seeds are not infrequently found in the products on the market, especially in alfalfa meal.

In a coarsely ground product, fragments of leaves, flowers, pods and seeds may be picked out and identified; but when powdered the unicellular hairs and crystals are the most conspicuous elements. Red clover may be distinguished from alfalfa and alsike clover by its larger, stiffer and more numerous unicellular hairs arising from a swelling of the epidermis ; alsike clover from alfalfa and red clover by the less distinct warts on the unicellular hairs.

The cell-walls of the epidermis of the leaf are also characteristic, those of alsike clover being straight, of alfalfa simply wavy, and of red clover very sinuous with projections at the angles and about the stomata.

The characters for identification may be summarised as follows :

	Alfalfa	Red Clover	Alsike Clover
Lower epidermis of leaf.	Wavy walls.	Deeply sinuous walls with projections at angles and about stomata.	Straight walls.
Unicellular hairs.	Average diameter 15 μ; warts prominent.	Average diameter 30 μ; warts prominent, arising from epidermal swelling.	Average diameter 13 μ; warts indistinct.
Palisade cells.	Less than 35 μ high, outer ends rounded.	More than 35 μ high, outer ends flattened.	More than 35 μ high, outer ends rounded.

352 – **A Note on Sex Determination.** — (Contributions from the Zoological Laboratory of the Museum of Comparative Zoology at Harvard College. No. 245). — PARKER, G. H. in *Science*, Vol. XXXIX, No. 997, pp. 215-216. New York, February 6, 1914. BREEDING,

In collecting a series of data to show the relation of the size of litters to the number of nipples in swine, the records noted the position occupied by the young pigs in the uterus, and it has therefore been possible to compare the products of one ovary with those of the other. Pairs of young pigs immediately against the ovary in the right horn of the uterus, similar pairs in the left horn, and pairs at the junction of the horns were tabulated according to whether they consisted of males only, of females only, or of males and females, the observations extending over 2600 pairs of unborn

pigs. In all three positions the frequencies of the pairs were approximately in the ratio of :

25 per cent.	males only
25 » »	females »
50 » »	males and females

showing that in the pig the ovaries exert no influence on the sex of the offspring by virtue of their position in the maternal body.

353 – **A Further Study of Size Inheritance in Ducks, with observations on the Sex Ratio of Hybrid Birds.** — PHILLIPS, J. C. (Bussey Institution) in *The Journal of Experimental Zoology*, Vol. XVI, No. 1, pp. 131-148. Philadelphia, Pa., January 5, 1914.

As the result of crossing Rouen ducks with domesticated mallards (*i. e.* races dissimilar in size but derived from the same wild species), the weights of adult birds showed an increased variability of the males in the F_2 generation, while the variability of the females remained practically the same as in the F_1 generation. No evidence was obtained in favour of the existence of simple and definite size units in the birds. A disturbed sex ratio occurred among the F_1 generation, resulting in a preponderance of males almost in the proportion of two to one, but equality in sex numbers was reestablished in the F_2 generation. Owing to the fact that other investigators have expressed a doubt as to the Rouen colouring being homozygous, the writer mentions that he obtained no evidence to the contrary in his experiments.

A number of growth charts are given and discussed.

354 – **Rudimentary Parthenogenesis in the Golden Pheasant.** — LÉCAILLON, M. in *Comptes Rendus hebdomadaires des Séances de l'Académie des Sciences*, Vol. 158, No. 1, pp. 55-57. Paris, January 5, 1914.

The writer had already remarked that unfertilized hens' eggs show traces of rudimentary parthenogenesis. He has made investigations on unfertilized eggs from a hen golden pheasant (*Chrysolophus pictus*) to find out whether the same applies to this species.

In the egg of this species, as in that of the hen, the cicatricula shows two distinct zones : a dense central one, and a peripheral one containing vacuoles of air. In unfertilized eggs the cicatricula is much smaller than in fertilized ones ; this is due to the fact that in an unfertilized egg the cicatricula spreads less over the yolk while passing through the oviduct. Under the microscope the dense part of the cicatricula shows blastomeres of varying size and of lenticular shape ; it is difficult to determine their number; in the peripheral part no subdivision of the cells can be determined. The blastomeres are composed of cytoplasm and deutoplasm and contain normal nuclei. They are therefore cells which have undergone true division, and not simply products of disintegration of the germinal vesicle. At the same time, as in hens' eggs, the nucleus is only visible in recently-laid eggs.

The degeneration of the blastomeres is often characterized by hypertrophy of the nuclei, again as in hens' eggs; these nuclei form numerous fresh nuclei of various sizes by budding.

The formation of the vacuoles in the peripheral part of the cicatricula takes place in the golden pheasant's egg in the same way as in the hen's egg; but in this part the degeneration of the deutoplasm takes place less rapidly than that of the nucleus.

These observations strengthen the idea that unfertilized eggs always show a tendency to develop like fertilized ones.

355 – **Some New Varieties of Rats and Guinea-Pigs and their Relation to Problems of Colour Inheritance.** — CASTLE, W. E. (Harvard University) in *The American Naturalist*, Vol. XLVII, No. 566, pp. 65-73. Lancaster, Pa., February 1914.

Attention is drawn to the appearance in England of two new colour variaties of rats, *viz.* (*a*) pink-eyed yellow, fawn, or cream and (*b*) black-eyed yellow, fawn, or cream. Both varieties originated in the wild state and were possibly introduced by ships from abroad. In captivity they have bred successfully, and both proved recessive when crossed with the wild race. The writer discusses some of the breeding results communicated to him by the fanciers who are in possession of the above animals, and the relation of these results to colour inheritance amongst mammals in general.

356 – **"Dominant" and "Recessive" Spotting in Mice.** — LITTLE, C. C. (Bussey Institution, Harvard University) in *The American Naturalist*, Vol. XLVIII, No. 566, pp. 74-82. Lancaster, Pa., February 1914.

A wild mouse with a 'blaze' on the forehead was crossed with a dilute brown individual which had been closely inbred. All the F_1 generation resembled the wild parent in coat colour, but had no trace of white. The F_2 generation contained animals of three types, *viz.*: I) self-coloured, II) those with a blaze, and III) those with a few white hairs on the forehead. Animals of type III, bred *inter se*, again produced the three above types, as did those of type II, though in this case the self-coloured animals produced only amounted to 1 per cent. Thus while spotting behaved as a *recessive* in F_1, it behaved as a *dominant* in certain of the F_2 individuals; yet, as the spotting character came from a single individual, it appears improbable that it should be of two distinct types.

The writer discusses his results together with those of Miss Durham and Hagedoorn, and concludes that dominant spotting is not caused by the presence of a factor restricting pigment formation in certain areas which is absent in the 'self' colour; neither can the presence and absence hypothesis account for the changing dominance which he observed, and which he attributes to a modification of supplementary factors.

WORK OF LIVE-STOCK ASSOCIATIONS AND OTHERS FOR THE ENCOURAGEMENT OF BREEDING.

257 – **Stock Breeding in Southern Italian Somaliland.** — SCASSELLATI-SFORZOLINI, GIUSEPPE, pp. 242 + 62 ill. and 1 map. Rome, 1913.

The climatic and geological conditions of the Protectorate of Southern Italian Somaliland (1) are on the whole well suited to stock breeding, though varying somewhat from place to place. This industry is the only source of income from agriculture, and the animals raised are chiefly cattle, sheep, goats, camels and donkeys. The herds of cattle graze upon the rich fertile meadows on the alluvial soil (*harra medou* = black soil) along the rivers Juba and Shebeli, while the camels are kept upon the less fertile alluvium (*harra gudud* = red soil) of the river valleys, and on the dunes (*harra adda* = white soil) which stretch along the sea-shore. Sheep graze after the cattle, and goats after the camels. There are no statistics as to the number of stock in the Protectorate ; but the writer estimates the numbers in 1910 at 764 000 cattle, 216 000 sheep and goats, and 305 300 camels and other domestic animals. In comparison with the other African colonies, Southern Italian Somaliland seems to be fairly well stocked.

I. *Breeds of Cattle.* — There are four breeds of cattle in the Protectorate, all of which are zebus : the Macien or Surca, the Gasara, the Dauara and the Magal. The two former are somewhat less primitive than the two latter.

Macien breed. — These are long-horned animals, probably from Ethiopia, and are also found in British East Africa. Colour usually red, seldom white, never black, often mottled with yellow ; head and neck nearly always red; a white line above the nostrils and round the ears is characteristic ; muzzle and hoofs yellowish to red. Hump low but very wide; dewlap and sheath of bulls very prominent. Skin generally coarse. Profile nearly straight; forehead broad and flat or slightly dished; ears medium-sized, slightly drooping. Limbs fairly well set on ; rump sloping. The height at the withers averages 4ft. 2 in ; horns 16 to 20 in. long. The live-weight of a bull in average condition is about 880 lbs., while that of a fairly good cow is about 660 lbs. Sexual dimorphism is very conspicuous in this breed. The cow gives little milk, but the fat content of the latter is high. It is a good beef breed.

Gasara breed. — These animals are short-horned, frequently hornless or with small cylindrical horns. Colour originally white, but pure-bred white individuals are rare; they are generally spotted with black and red; muzzle and hoofs black, as also the tip of the tail. Hump higher than broad; dewlap and sheath rather prominent in animals which are not pure bred. Skin thin and fine. Face distinctly dished; forehead not very broad ; ears larger than in the Macien and horizontal. Position of legs good to very good. Rump less sloping, and sexual dimorphism less strongly marked than in the Macien. Height at withers about 3 ft. 10 in. ; horns up to 8 in. Live-weight of a cow in average condition about 550 lbs., of a bullock 660 lbs. The cows are excellent milkers. The breed is susceptible to trypano-

(1) The area of the Protectorate was about 12000 sq. miles up to March 1912, when a further 62000 sq. miles were added; the studies were made from September 1911 to June 1912, and therefore chiefly relate to the area annexed before March 1912.

somiasis, but this disease is not of frequent occurrence. The Gasara breed is widely spread in Southern Italian Somaliland, including the dunes along the coast, and is also found in British Jubaland.

Dauara breed. — The writer believes this breed to be derived from a cross between the two previously mentioned. There are occasional very large animals with small black horns. Colour whole chestnut. Dewlap, sheath and purse very prominent. Hoofs black. Tip of tail reddish. Ears long. Skin very fine, forming folds at the neck. Udder of cows large. These cattle are suitable for both milk and beef production.

Maga breed. — Short-horned, small and badly-shaped. Colour black, but often flecked with white on head and body. Hump very large. Head long with dished forehead. It is not a favourite breed owing to its poor performance and its black colour.

II. *Camels.* — These are exclusively one-humped ; the Somalis divide them into several races by their colour.

III. *Goats.* — These all belong to one type; the height at the withers is 24 to 30 in. and the live-weight 55 to 88 lbs. They are usually white, seldom red and never black; generally pied, particularly white with head, legs and a stripe down the back red or black; red-headed animals generally have two white stripes running from the eyebrows to the nostrils. Ears fairly long, upright or slightly drooping. Sexual dimorphism marked: males have the head large and the neck thick, and backwardly curved horns; along the back there is usually a strip of silky hair. The females are more slightly built, and have a well shaped udder. The Somalis distinguish two breeds: a long-eared one for milk and a short-eared one for meat production.

IV. *Sheep.* — These, like the goats, all belong to one type. The height at the withers is 26 to 28 in. and the live-weight 55 to 88 lbs. Body white, with head generally black, but not infrequently red, or white like the rest of the body. Face strongly dished ; small horns sometimes occur in the rams, but the ewes are always without them ; ears long and drooping. The Somali sheep has no wool, and is a fat-rumped species belonging to the group of *Ovis steatopigia* or *ecaudata.*

V. *Donkeys.* — These are descended from the Somali wild breed (*Equus asinus somali*) and are much lihe the Abyssinians. They are slate-grey and stand 9.2 to 11 hands high. Head heavy, face dished ; ears smaller than in the European donkey. Herds of donkeys are very little kept.

Mules are of very secondary importance ; as there are no horses, all are imported from Eritrea and Abyssinia.

There are very few *ostriches, fowls* or *bees.*

VI. *Methods of stock-keeping and rearing.* — In the neighbourhood of villages where there is a constant market for milk and meat, a certain number of cattle are kept stationary; during the day they graze near the village and at night are shut up in enclosures called *zeribe* ; in the dry season they sometimes get a little fodder. Otherwise the herds migrate from place to place according to the condition of the pastures.

The Somalis make some attempt at selecting their bulls ; only the finest are reared, and eventually those producing good daughters are kept on as

sires. On the other hand all heifers are put to the bull, the reason being that milk and veal are the chief foods of the natives. Bulls come into service at 2½ or 3 years, while the heifers are put to them at 2 to 3 years.

The calves are weaned at 4 or 5 months, which is decidedly too soon, especially as their dams are also milked.

The Somalis have no knowledge of hay- making. When the rivers and springs dry up, they dig wells for watering the cattle.

VIII. *The economic value of the stock and its products.* — The value of the stock to the natives depends chiefly upon its milk and meat production. The camel is prized for both these reasons, and also for the work it performs. The daily milk yield of a fairly good cow is about 5 quarts, and a she-camel will give this amount besides what the calf takes. The price of milch animals depends on their yield ; a good cow fetches from £ 3 to £ 5 and a very good milch camel from £ 4 to £ 5. Cow's milk is sold at 9*d* a gallon and camel's milk at 4 ½ *d*. Superfluous milk is made into butter, and this and the skim milk are favourite foods; the price of butter is about 8*d* per lb. Most of the butter exported goes to Arabia and Zanzibar. The amount exported has fallen from 500 000 lbs. in 1905-06 to 145 000 lbs. in 1911-12.

The meat production, although chiefly destined for home consumption, is already considerable. The natives like to turn to account all otherwise useless animals by slaughtering them for food. The Macien breed is the most suitable for fattening owing to its early maturity. The price of cattle for the butcher varies with the weather and the diseases prevalent. At present, a good fat ox fetches 19 *s* to 35 *s*, while the price of an average sheep is 6*s* to 8*s*.

The price of meat continually varies with the price of the animals slaughtered; at Jumbo and other coast towns beef costs about 1 ¾ *d* per lb., and at Gelib only a little over 1*d* per lb. A pound of mutton costs 3 ½ *d* at the first-named places. The entire trade in meat and animals for the slaughter-house is a monopoly of the Arabs, Indians and natives, who ship all superfluous cattle to Aden, Mombasa and Zanzibar. Table I shows the importance of the export trade in animals for the slaughter-house from 1905 to 1912.

TABLE I.

Year	Cattle		Sheep and Goats	
	Number of head	Value £	Number of head	Value £
1905-1906.	1 751	2 602	10 272	2 396
1906-1907.	1 727	2 643	9 157	1 631
1907-1908.	3 295	2 600	7 733	1 735
1908-1909.	1 959	3 758	8 280	1 968
1909-1910.	1 507	2 678	7 361	1 833
1910-1911.	1 694	4 356	7 642	2 122
1911-1912.	1 943	3 896	7 113	1 976

Animals are little used for work, except camels. Only one or two hundred camels are exported annually, at from 47*s* to 55*s* per head. More important articles of export than draught animals are hides, of which the following numbers were exported between 1905 and 1912 :

Ox hides	to the	value of	£	18 061
Camel skins	» »	»	£	729
Sheep and goat skins	» »	»	£	10 735

The value of the ostrich feathers annually exported amounts to some hundreds of £.

IX. *Encouragement given by the Government to stock-breeding.* — The Government has founded an inoculation station where animals are inoculated in order to protect them from the more dangerous diseases. Up to the present, many thousands of cattle have been successfully treated, to the great satisfaction of the natives. Further, the Government has issued regulations for the protection of grazing concessions (extending over 10 years) and the use of pastures. At Merca, a Stock-breeding Station (Stazione sperimentale d'incrocio e di selezione) has recently been established; it has already been supplied with different native breeds of cattle, and has set itself the task of finding out the best breeds, and the most suitable breeding methods. By a Decree of September 12, 1912, a department was instituted in the local colonial administration to take charge of stock-breeding (Direzione dei servizi zootecnici).

Stock breeders' tasks. — According to the writer, the chief aim of the stock breeder in Southern Italian Somaliland should be the production of meat for exportation to Italy. This is impossible at present, for the conditions requisite for obtaining a large supply of cattle are wanting. If, however, certain measures were carried out, the Colony would easily be able to make up the deficiency in the meat supply of the Motherland. Such measures would include :

1) The improvement of the breeds of cattle by means of selection, or methodical crossing, and the changing of the grazing methods of the natives.

2) The establishing, in one of the coast towns of the Colony, of a Society with large capital, which would be in a position to take over the cattle and meat trade.

3) The improvement of the communication with Italy and the providing of the ships with cold-storage chambers for meat.

The Government, on its side, must take effective measures for the control of diseases. This will be best done by turning the Inoculation Station into a modern institute for serum preparation, and making a quarantine station on the coast. In addition, the writer requires that the Government should create a bureau of information on stock breeding and an experimental stock farm, mainly for the assistance of the Italian colonists, who are still few in number.

Lastly, the writer counsels the acquisition of only large ranches, say 25 000 acres, which should be devoted to meat production. According to

careful calculations, such a farm, after a few years, could supply annually to the meat market at a high profit 400 head of cattle and 1000 lambs. The production-cost per 100 lbs. of meat would be about 22*s* 9*d*, that is relatively little.

358 – **The Condition of the Breeders' Associations in Germany in 1912.** — KNISPEL, OSKAR in *Mitteilungen der Deutschen Landwirtschafts-Gesellschaft*, Year 28, No. 51, pp. 687-690. Berlin, December 20, 1913.

The following tabular summary gives the objects and number of the Breeders' Associations in Germany, the number of registered animals and the numerical increase (+), or decrease (—), for the year 1912.

TABLE I.

Breeders' Associations for:	Number of Associations	Animals registered	Increase (+) or decrease (—) in the animals of 1912 as compared with the preceding year
Horses	246	65 187	+ 1 553
Cattle	1 627	410 953	+ 12 938
Sheep	9	4 542	— 31
Pigs	171	19 729	+ 1 452
Goats	916	55 108	+ 7 655
Total	2 969		

In comparison with the preceding year, 1912 shows an increase of 293 associations, of which 16 are devoted to horses, 45 to cattle, 1 to sheep and 235 to goats; the pig-breeding associations have decreased by 4.

The largest number of registered horses is to be found in Hanover, where 9 658 head are entered. Schleswig-Holstein takes the lead as regards cattle, with 54 362 registered, while Brandenburg heads the list for sheep, with 3 040 and Hanover for both pigs and goats, with 6 916 and 20 559 respectively.

The registered animals all belonged to the following breeds :

TABLE II.

Division and Breed.			*Number of Animals.*
Horses	German Thoroughbreds	stallions	1 985
		mares	42 432
	Draught horses	stallions	712
		mares	20 058

Division and Breed.			Number of Animals.
Cattle	Mountain cattle	bulls	10 297
		cows	118 380
		heifers	14 325
	Lowland cattle (including Shorthorns)	bulls	14 212
		cows	239 545
		heifers	14 194
Pigs	German Improved pigs	boars	333
		sows	1 856
	unimproved native pigs	boars	94
		sows	340
	improved native pigs	boars	2 974
		sows	13 817
	other breeds	boars	42
		sows	273
Goats	White Saane breed	males	1 942
		females	31 596
	Coloured breeds	males	597
		females	21 071

359 – **Calf-Feeding with Blatchford's Calf Meal.** — GIULIANI, RENZO in *Annuario della Istituzione Agraria Dott. Andrea Ponti*, Vol. II, pp. 37-50. Milan, 1914. CATTLE

Blatchford's Calf Meal is a greyish red, not very homogeneons meal with a pleasant favour; it contains 45.84 per cent. of nitrogen-free extract and 20 per cent. digestible protein. It is the product of an American firm, and is offered as a substitute for milk in rearing calves; 1 lb. of the meal in one gallon of water is regarded as the equivalent of one gallon of milk.

The writer has lately carried out a rearing experiment at the Agricultural College at Milan upon five Bergamasco calves from six to twelve days of age, in order to ascertain how far this substitute can actually replace milk. The animals were, for this purpose, divided into two lots; lot I consisted of two calves, and lot II of three. The calves were fed as follows:

Period	Lot I	Lot II
first	milk	milk
second	milk + meal	milk + meal
third	meal	milk (2 calves); milk + meal (1 calf).

In lot I, 1lb. of meal in a gallon of water was substituted for a gallon of milk, while in lot II the amount was 2 lbs. of meal in a gallon of water. In the third period, the experimenter had intended to entirely replace the milk (also in the case of lot II), but already at the close of the second period the calves refused the food, so that two of the animals were again given milk, while the third was fed as before. The rations were always measured according to the appetite and the live weight of the calves. The experiment lasted 57 days in the case of lot I and 90 days in that of lot II.

Results: the health of all the animals was very good throughout the first, or milk, period. The same may also be said regarding the first part of the second, or mixed food, period. But the more milk was subsequently replaced, the greater the loss of appetite shown by the animals. The calves of lot I only readily took up to 21 oz. of meal, and those of lot II refused to eat more than 28 oz. In the third, or meal, period the appetite of the calves of lot I decreased so much, that it was necessary to change the feeding after a few days to prevent death. It was found impossible to substitute meal entirely for milk in the case of lot II. During the time that they were fed on meal, the calves were low-spirited and out of sorts and suffered from attacks of shivering and diarrhoea. The urine and faeces were evacuated in larger amounts than usual; the faeces were always coloured, and contained particles of undigested meal. If the animals were again given milk, they regained their usual appearance after a few days. In the case of both lots, the live weight decreased with the increase of the meal ration.

The results of the experiment lead to the conclusion that Blatchford's Calf Meal cannot entirely replace milk, either from the physiological or the economic point of view. Physiologically, though not economically, it can be used with success under some circumstances as a partial substitute for milk.

360 – **Studies of the Irish Kerry Cow.** — FUNDWALL, E. in *Mitteilungen der landwirtschaftlichen Lehrkanzeln der k. k. Hochschule für Bodenkultur in Wien*, Vol. 2, Part 2, pp. 331-374. Vienna, November 29, 1913.

The writer first gives a detailed description of the climate and soil of Ireland, and then speaks of the distribution, feeding, management, breeding and performance of the Kerry cow. He then proceeds to describe the Dexter, and subsequently gives the measurements of 19 typical skulls, comparing the measurements with those of the skulls of the red Breton and Polish breeds. In the last chapter, the writer gives a summary of the history of the Kerry cattle.

The study of the skull and body measurements of the latter revealed their almost complete agreement, in these respects, with the *brachyceros* red Breton and Polish breeds. The *brachyceros* characters were far more marked in most of the Kerry skulls examined than were the *primigenius* characters. The latter characters were generally only recognizable in the formation of the forehead, the shape of the nasal and lachrymal bones, and that of the temporal fossae.

The conclusion to be drawn is that the Kerry cattle are very nearly related to the red Breton and Polish breeds, and consequently, like these, do not belong either to the *primigenius* or the *brachycephalus* (Werner) group but should be included in the *brachyceros* group.

361 – **The Distribution of the Wild Sheep in relation to Watersheds.** – KOWARZIK, RUD. in *A. Petermann's Mitteilungen aus Justus Perthes' Geographisches Anstalt*, Year 60, February Number, pp. 70-72. Gotha, 1914. SHEEP

The writer shows that the distribution of the 50 forms of wild sheep in the Holarctic region is largely according to river-basins, watersheds forming the limits between the areas of neighbouring forms.

362 – **Pig Feeding Experiments.** — MEYER, G. and FINK, E. in *Sonderabdruck aus Mitteilungen der Vereinigung Deutschen Schweinezüchter*, 6 pages. (undated). PIGS

In the year 1913, at the suggestion of the "Vereinigung Deutscher Schweinezüchter", a ten weeks' feeding experiment with 260 pigs of the improved local breed, weighing uniformly about 148.5 lbs., was conducted, with the chief object of judging the relative value of dry and moist feeding (1). The animals, which were fed according to their appetites, were divided into thirteen lots of twenty each. The dry food was supplied by a Thimann's dry food automatic feeder; the moist food was given as a stiff paste.

The results of the first eight lots, in which four different mixtures of food were compared with each other, are shown in Table I.

In this table only the cost of the food is considered; all the other factors, such as cost of management, rent of sties, as well as the value of the manure produced, have been omitted.

TABLE I.

Food given	Fed moist				Fed dry			
	Increase	Consumption of food	Cost of food	Cost of 1 lb. of increase	Increase	Consumption of food	Cost of food	Cost of 1 lb. of increase
	per day, per pig				per day, per pig			
	lb.	lb,	*d*	*d*	lb	lb	*d*	*d*
1/3 Axa, (*) 1/3 barley groats, 1/3 potato flakes + blood meal	0.93	4.27	3.6	3.9	1.03	4.95	4.2	4.1
Barley groats, Fattinger's grain blood food .	0.96	4.87	4.1	4.2	0.96	5.13	4.3	4.5
Barley groats, blood meal	0.99	4.81	3.9	4.1	0.91	5.03	4.2	4.6
Barley groats, fish meal	0.89	4.85	3,9	4.4	1.00	5.74	4.8	4.8
Average . . .	0.94	4.66	3.8	4.1	0.97	5.21	4.3	4.5

(*) A preparation of maize.

(1) See No. 1270, *B.* Nov. 1913. (*Ed.*)

With the dry food, the pound of increase of live weight costs a trifle more than with the moist food. On examining the records of the separate weeks it is found that in some weeks dry feeding was more advantageous and in others moist. The final result is not therefore absolutely reliable, as it would have varied had the experiment been stopped at another date. Nevertheless it may be stated that the two ways of feeding cost about the same. As for the mixtures of food, the writers observe that the first mixture seemed to suit the pigs particularly well, though the others all caused a normal development of the animals.

Table II contains the results of the five remaining lots, in which five different food mixtures were compared. The first four mixtures were given moist and the fifth dry.

TABLE II.

Food given	Increase	Consumption of food	Cost of food	Cost of 1 lb. of increase
	per day and per pig			
	lb	lb	*d*	*d*
Axa and blood meal.	0.63	4.22	3.6	5.7
1/3 Axa, 1/2 barley groats + blood meal.	1.42	5.19	4.3	4.2
1/3 Axa, 2/3 barley groats + blood meal	0.98	5.06	4.2	4.3
1/4 Axa, 1/4 barley groats, 1/2 potato flakes + blood meal.	0.93	4.42	3.7	4.0
Barley groats and dry yeast	1.14	5.41	4.4	3.9

The mixture of Axa+bloodmeal was not a great success; the animals did not seem to relish it much and remained inferior to the others. On diminishing the amount of Axa fed, the animals showed more appetite. As regards the other mixtures, it is to be noted that potato flakes always produced after a short time a feeling of satiety, and that dried yeast, though at first not willingly taken, proved a good and wholesome food.

At the butcher's test no difference could be detected between the flesh of the pigs that had been fed dry food and the flesh of the others. Too much Axa food made the fat softer and slightly yellowish.

POULTRY.

363 – **Early Identification of Good Hens.** — WILSON, J. (Royal College of Science, Dublin) in *Journal of the Department of Agriculture and Technical Instruction for Ireland*, Vol. XIV, No. 2, p. 240. Dublin, January 1914.

An important observation has been recorded in connection with the egg-laying competition at the Munster Institute (Cork). It was found that a hen's total egg yield for the year could be predicted from her performance during the first eight or ten weeks of the laying season (November, December, January). Good layers laid about five eggs a week, very seldom

Schuman sun power plant.

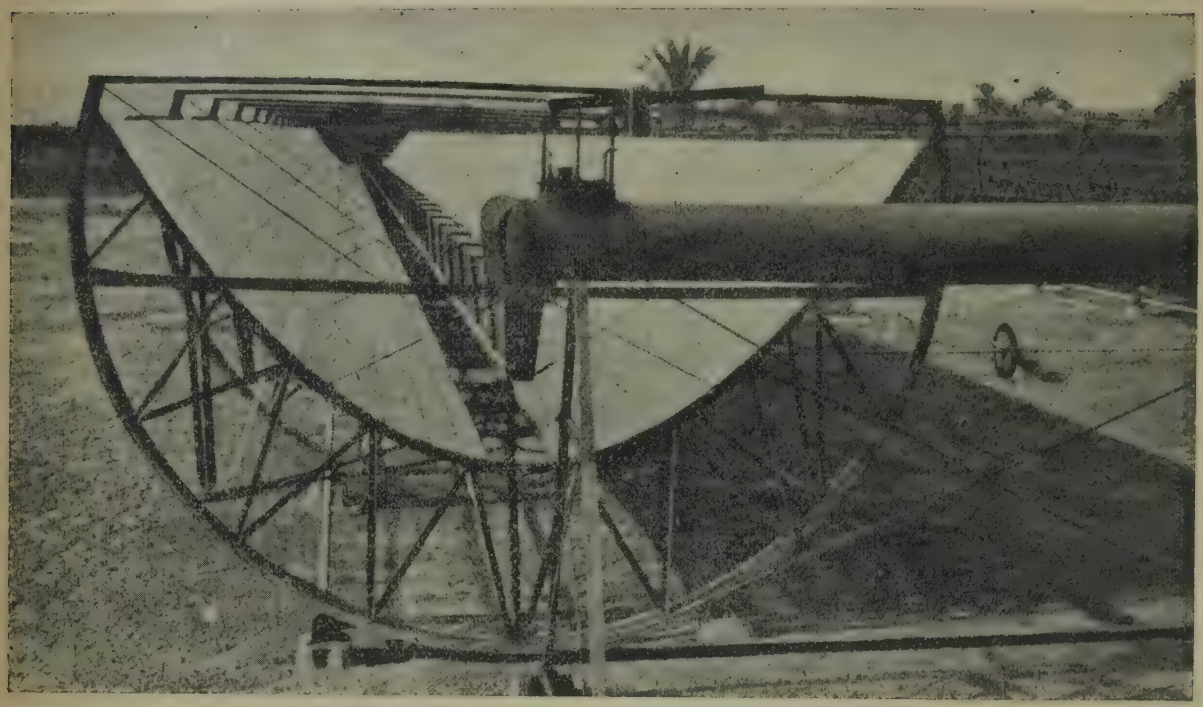


Fig. 1.

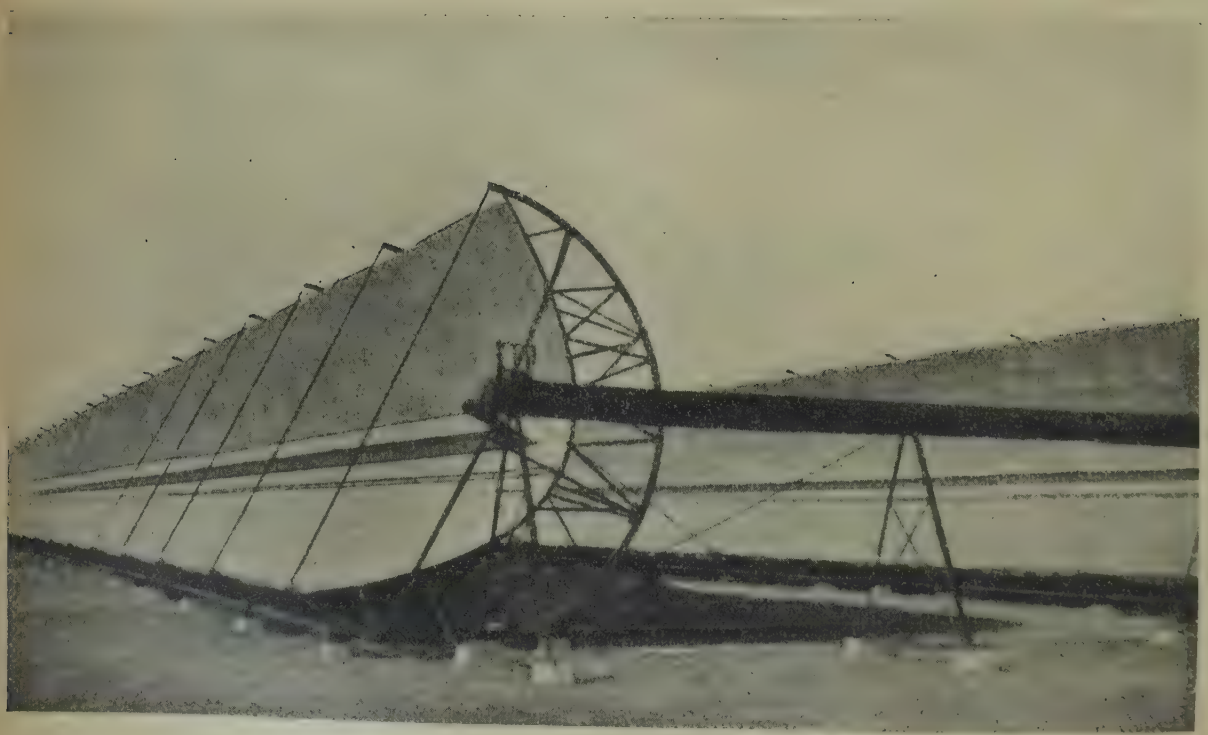


Fig. 2.

having two successive blank days, and continued at this rate for eight or ten weeks. Medium layers had blanks of several days at a time, or did not give a continuous steady yield during the same eight or ten weeks, while bad layers laid very few or no eggs during the period.

FARM ENGINEERING.

364 – **The Shuman Sun Power Plant.** — *The Implement and Machinery Review*, Vol. XXXIX, No. 467, pp. 1515-1517. London, March 1, 1914.

The direct utilisation of solar energy for the production of mechanical power has long presented an interesting problem. One practical solution to it has been found by Mr. Frank Shuman of Philadelphia, who has been at work upon it for the last seven years. He has now in operation near Cairo, Egypt, the sun-power irrigation plant shown in the accompanying illustrations.

It consists primarily of five heat absorbers, a 100 HP low-pressure condensing engine and a reciprocating pump. Fig. 1 is a view of one of the heat absorbers and Fig. 2. shows two of them in a tilted position. The absorbers carrying the boilers are set due north and south on rollers and gears on concrete foundation posts, and are slowly turned so as always to face the sun. They are 200 ft. long, and 13 ft. wide at top, and consist of light parabolic frames set with silvered mirrors which catch and reflect the heat of the sun on to the long flat-bottomed boilers suspended in the line of foci of the mirrors. The steam, which is not allowed to rise above one atmosphere pressure, is collected by a 3 ½ inch pipe running along the whole line, whence it is conveyed to the engine by the main steam pipe. After doing its work the steam in the engine is condensed into water and pumped again into the boilers; the danger of clogging the boilers with mud or scale is thus minimized.

The cost of power production by this system is claimed to be equivalent to using coal at 9*s* 8*d* per ton, whilst in Egypt and the Sudan the price of coal is given as over £ 3 per ton.

365 – **New Rotary Tilling Machine: The "Motoculteur."** — *Les Inventions Illustrées*, Year 17, No. 2, p. 7. Paris, January 20, 1914.

The main feature of this machine is a rotary digger with flexible claws. Its advantages are lightness, great facility of management, and the uniform and complete working of the soil at one operation.

The following are the official returns of crops grown at Grignon on land worked by this machine:

	Total weight	Straw	Grain
	lbs.	lbs.	lbs.
With 178 lbs. of seed per acre	8080	5590	2490
» 107 » » » » »	9150	6650	2500

This machine, destined for vineyards and market gardens, is built by the "Société de la Motoculture Française" in Paris.

366 – **The "Detroit" Rein-Steerage Gasoline Tractor.** — *The Implement and Machinery Review*, Vol. XXXIX, No. 467, p. 1520. London, March 1, 1914.

Great economy of agricultural labour is effected by several recent machines ; thus some motors and binders have been built, two of which can be driven by one man.

Recently the Detroit Tractor Co., Detroit, Michigan, U. S. A., have built a tractor which is controlled by the man sitting on the reaper, plough or whatever implement is being operated, the tractor being driven, like a team of horses, by reins.

The steering is accomplished by a pull on the right or left steering rein. A pull on both reins stops the engine. The third rein moves the gears from a neutral position to " forward " or " back " and, exceptionally, in hilly country, a fourth rein is used to work the brake.

367 – **Ditch-Excavating Machine.** — *Engineering Record*, Vol. 69, No. 1, p. 4. January 3, 1914.

The F. C. Austin Drainage Excavator Company of Chicago have built a ditching machine which cuts ditches of 5 ½ feet maximum depth with a 5 foot bottom. The sides are cut with a 1 : 1 slope so that the maximum top width possible is 16ft. The traction is so designed as to permit the machine to turn a complete circle with one wheel stationary. The outfit illustrated is worked by a 50 HP gasoline engine. In ground composed of dry alluvial soil the machine is claimed to have excavated 175 cu. yds. per hour. The cost of operation is about $ 15 per day. The outfit can be operated by one man.

368 – **New Machine for Renovating Grass Lands.** — FRANK in *Georgine, Land- und Forstwirtschaftliche Zeitung*, Year 7, No. 6, p. 33. Königsberg i Pr., January 17, 1914.

Old or thin meadows are sometimes renovated by lightly working their surface with tooth or disk harrows or similar implements and then broadcasting grass seeds over them. Hitherto no implement existed which combined the least injury to the existing turf with the guarantee that all the seed cast reached the seed bed.

Such an implement, which may be called a « furrow-drill for grassland », has now been constructed and patented in the German Empire under No. 261 242.

The feeding shaft is driven by an endless chain on the hub of the right rear wheel. It is thrown into or out of gear by a clutch. The quantity of seed is controlled by a feed regulating device which allows a range of from 5 ½ to 22 lbs. of seed per acre. The furrow-openers and coulters are raised or lowered by a hand lever as in cultivators. The furrow-openers are fastened to a strong support, so that, as is shown in fig. 1 (in which *a* is the furrow-opener, *b* the coulter), they penetrate to a depth of only 1.2 inch into the soil, while the coulters cut 2 to 2 ¾ inches deeper ; thus the seed does not descend too deep into the soil and yet the latter is loosened to a greater depth and prepared for the reception of new roots. Experiments have shown that the seed drilled with this machine germinated very well. The drills are situated 5 ½ inches apart. In some cases where thick sowing is desirable the grassland can be drilled a second time cross-wise to the first drilling.

According to the depth of the work done, two or three medium horses are required to draw the machine, and 10 to 12 acres can be sown in

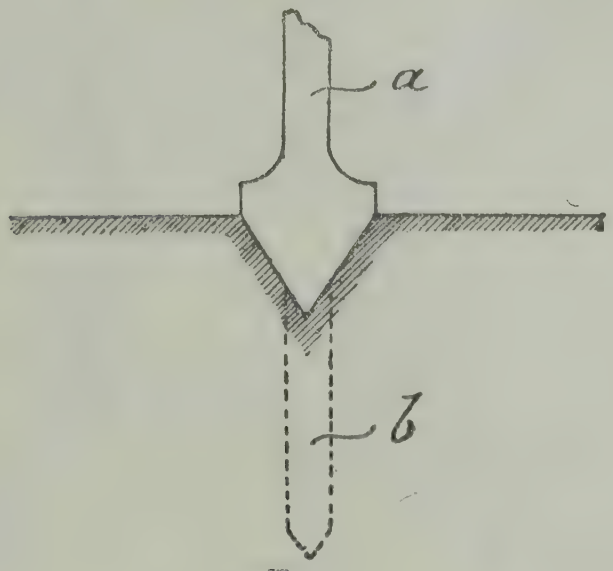


Fig. 1.

Grassland renovator. — Furrow-opener.

10 hours. Compared with other methods of renovating grasslands this implement saves much labour and seed.

The machine is built and sold by the Cooperative Machine Association at Konigsberg.

369 – **A New Appliance for Elevating Grain and Granular Goods.** — GREINER, W. in *Zeitschrift des Vereines Deutscher Ingenieure*, Vol. 58, No. 4, p. 154. Berlin, January 24, 1914.

The new flexible metal tubing invented by Jacob Bros., of Zwickau i. S., differs essentially from the metal tubing hitherto used; the latter cannot be used everywhere because its inside presents depressions or grooves in which some of the stuff conveyed lodges, and thus increases the resistance to the passage of the bulk of the same.

This new tubing is formed by two special steel or bronze bands wound spirally and forming an outer and an inner pipe. The inside of the latter is a succession of overlapping smooth surfaces. As packing, an asbestos cord is wound round the tube. According to experiments, this tube allows the passage of about 30 per cent. more grain than the old types in the same time, and its duration is four to six times greater. The various lengths of tubing can be joined to each other by flanges or conical couplings. The tubing is manufactured in various sizes, the largest reaching 20 inches in diameter. For elevating grain or the like from the holds of ships it is made especially light so as to be very flexible.

Figure 1 shows a side view of a piece of tube, Fig. 2 a section and Fig. 3 the tubing at work.

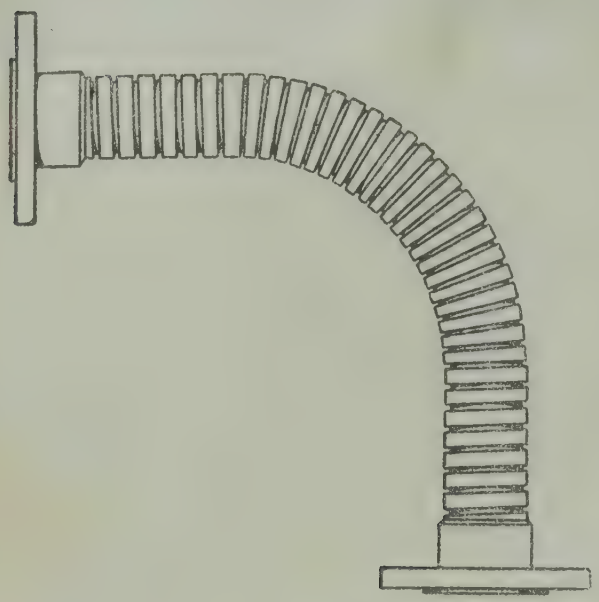


Fig. 1.

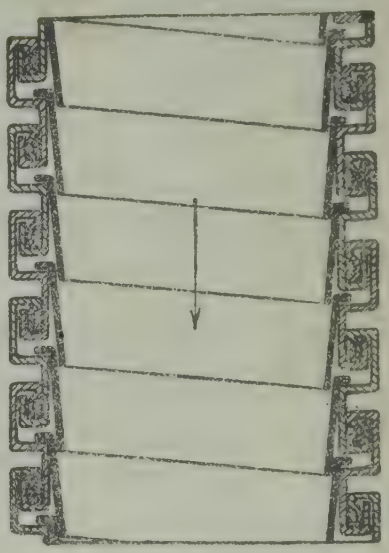


Fig. 2.

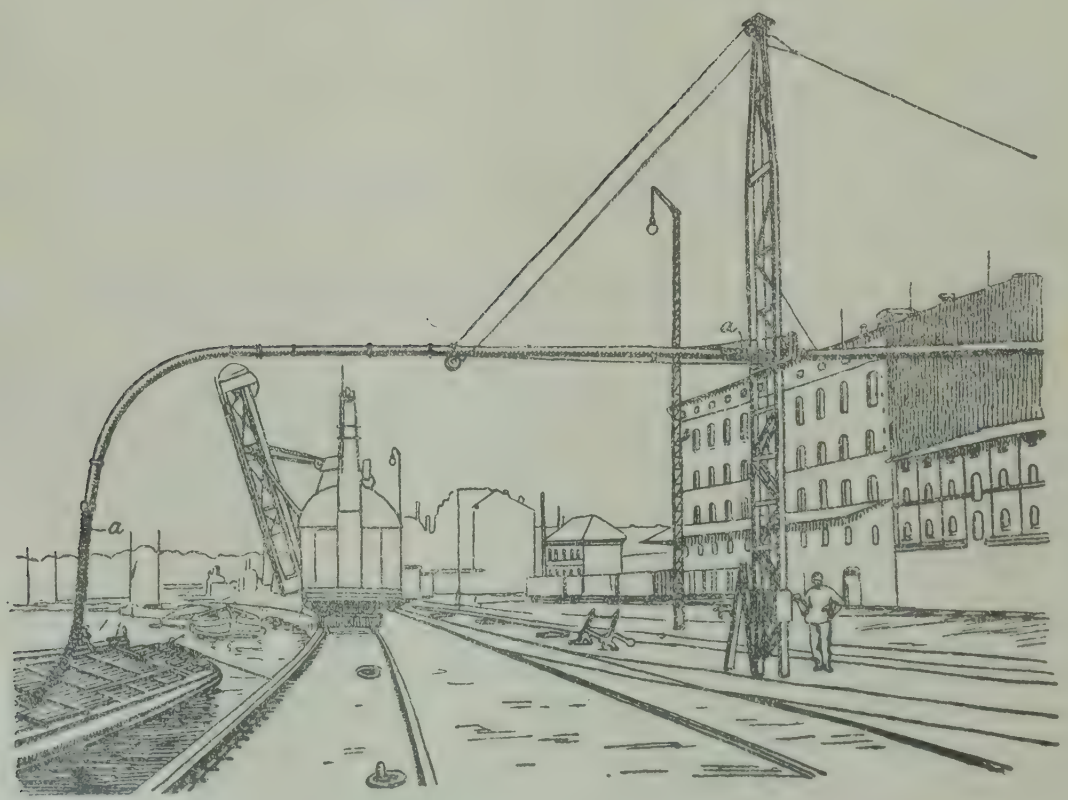


Fig. 3.

Grain elevator.

370 – Process and Apparatus for the Extraction of Sugarcane Juice. — MENGELBIER, O. in *La Sucrerie indigène et coloniale*, Year 49, No. 1, pp. 3-7 + 2 figs. Paris, January 7, 1914; and Patent N. 549748.

The writer has invented a process and an apparatus for the improved extraction of sugarcane juice by means of mills. The invention consists of:

1. A process of extraction, the characteristic feature of which is that the bagasse is first treated by steam (preferably in a chamber allowing of

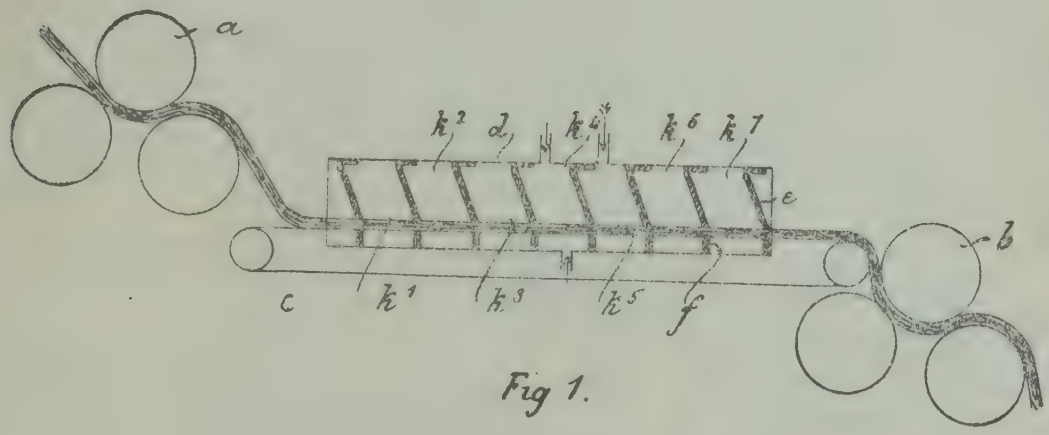


Fig 1.

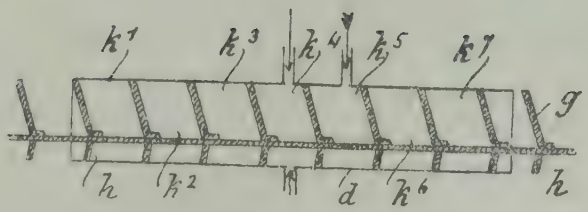


Fig 2.

Apparatus for the extraction of sugar-cane juice.

a certain pressure above that of the atmosphere so as to attain the temperature required to burst the cells of the outside layers of the cane and of the hard knots), and then, in another chamber, supplied with the quantity of diffusion liquid that is still necessary.

2. An apparatus for carrying out the process, the principle of which is that the bagasse is conveyed between two pressings through a chamber which is as air-tight as possible.

3. A detail of the apparatus consisting in placing before and behind the principal compartments one or more compartments in which the steam that escapes may condense upon the bagasse. This is done to avoid the losses of steam due to the chamber not being sufficiently air-tight.

The accompanying figures show one form of the chamber consisting of several compartments k^1 to k^7; *a* and *b* are sets of rollers, *c* is an endless

canvas conveyor or similar device for carrying the bagasse through a channel-shaped vessel *d*. In order to obtain approximately air-tight chambers, shutters or partitions (*e*, *f*, fig. 1; *g*, *h*, fig. 2) are used ; they may be rendered more air-tight by rubber strips or other similar material. In fig. 1 the partitions (*e* and *f*) are borne by the vessel *d*, while in fig. 2 they (*g* and *h*) are carried by the endless conveyor and rub against the sides of *d*.

Steam is introduced into the chamber k^4, where it warms the bagasse and penetrates into it ; part of the steam is condensed and part escapes into the neighbouring compartments k^3 to k^1 and k^5 to k^7. In the former it comes in contact with the cold bagasse, which it warms, while the steam which gets into compartments k^5 and k^7 is condensed by the imbibition liquid which is introduced into k^6 and which is preferably already strongly heated ; this liquid, together with the condensed steam, causes the sugar to diffuse out.

371 – **Simon's "Star" Sack Cleaner**. — *The Implement and Machinery Review*, Vol. XXXIX, No. 465, p. 1211. London, January 1, 1914.

Sacks being employed in vast numbers, some wholesale mechanical method of cleaning them is often required, and in such cases the Star Sack Cleaner, shown in the accompanying figure (made by Messrs. Henry Simon Ltd., Manchester) appears to be invaluable. The sacks, 100, 200 or 300 at a time according to the size of the machine, have simply to be thrown into the revolving chamber. The sacks are not fixed or held in any way, but are tumbled about inside the drum, and after half an hour are cleaned unless caked inside, in which case they require turning. The dust and dirt leave the machine through a wire screen round the drum.

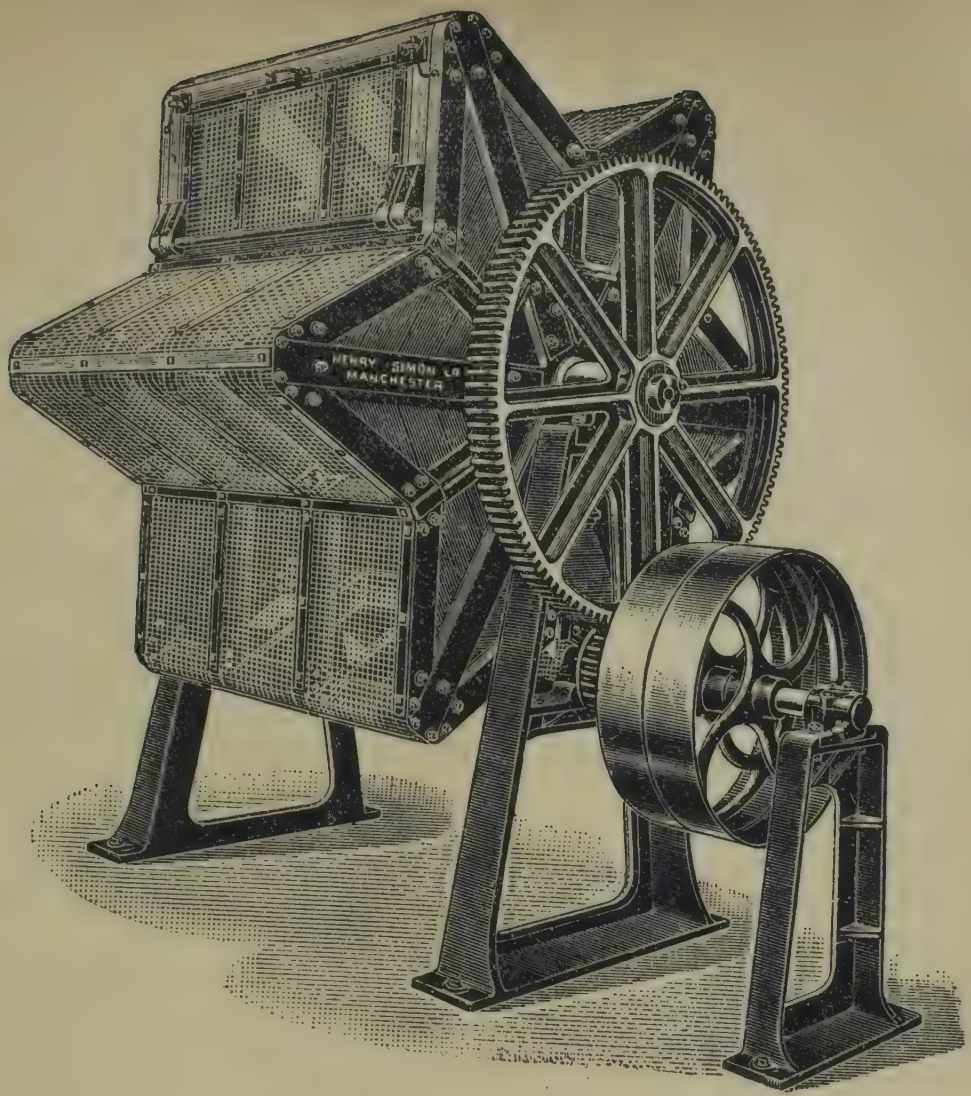
These cleaners have been adopted by many large flour mills and other establishments which use sacks. They are built in three sizes. The lengths of the machines are 5, 7 and 9 feet respectively. The gross weights are 55, 60 and 70 cwt. The width and height of the machines are the same for each size, namely 8ft. 6 in. by 10 ft. 7 in.

372 – **A New Cattle Cart.** — *Deutsche Schlacht- und Viehhofzeitung*, Year 14, No. 5 p. 68. Berlin, February 1, 1914.

The cattle cart shown in the accompanying figure is so constructed that its back can be let down so as to form a bridge for loading or unloading cattle. In the same way the two front halves of the sides of the truck can be let down as bridges; these bridges can also be placed in the doorway of a railway cattle truck, so that the animals can go straight in from the cart.

373 – **Mechanical Requisites in Cyprus** — *The Implement and Machinery Review*, Vol. XXXIX, No, 467, p. 1500. London, March 1, 1914.

The tillage implements used in Cyprus have hitherto been of the most primitive type. The Agricultural Department of Cyprus has been trying to introduce modern appliances by practically giving implements to some growers or by hiring out machines under easy conditions. As soon as the growers were able to judge of the value of new farm requisites, the Department withdrew from the market and left the trade to makers and agents. As a result of this policy the imports of these articles have grown rapidly



Simon's "Star" sack cleaner.

New cattle cart.

and in 1912 they amounted to £1175. The bulk of the trade is in English hands, but ploughs have been shipped from Russia and other implements from Germany and Austria.Some reapers and binders and threshing machines have been introduced, and wind engines are employed freely for irrigation purposes. On the whole the country offers good promise for the future.

374 – Review of Patents.

Tillage implements and machines.

63 394 (Austria). Adjusting device for fore-carriages of cultivators and the like.
64 241 (Austria) Hoeing apparatus for agricultural motors.
64 243 (Austria). Appliance for increasing the adhesion of driving wheels in ploughing machines.
64 245 (Austria). Steering gear for ploughing machines with steering wheel.
261 179 (Belgium). Process for treating sandy and dry soils previous to cultivation.
262 120 (Belgium). Regulator for inclination of simple and double Belgian ploughs.
262 240 (Belgium). Handle attachment which can be applied to double Belgian ploughs.
460 148 (France). Planting and hoeing machine.
460 572 (France). Arrangement for shifting laterally the beams and shares of ploughs.
461 246 (France). Improvements in tilling machines.
461 267 (France). Motor plough.
461 283 (France). Cultivator.
463 512 (France). Improvement in double and single ploughs applicable to revolving or fixed beams.
269 517 (Germany). Motor plough with cleated wheels.
269 717 (Germany). Wheel with adjustable cleats for agricultural motor machines.
269 719 (Germany). Motor plough.
270 902 (Germany). Multiple-furrow gang ploughs.
271 493 (Germany). Cable with laterally adjustable rollers for motor balance-ploughs.
271 521 (Germay). Motor plough with rear steering wheel.
271 713 (Germany). Wheel with shovel ceats for motorcar for agricultural machines.
17 569 (United Kingdom). Land levelling appliance.
1 086 427 (United States). Plough attachment.
1 086 449 (United States). Attachment for cultivators.
1 086 761 (United States). Cultivator.
1 086 860 (United States). Gang plough.

Manure distributors.

64 244 (Austria). Device for regulating the quantity of manure spread by manure spreaders.
269 394 (Germany). Manure spreader.
269 863 (Germany). Manure spreader.
270 734 (Germany). Farmyard manure spreader.
270 801 (Germany). Nitrate of soda spreader.

Drills, sowing machines and planters.

460 569 (France). Change of speed for drills.
271 659 (Germany). Combined drilling and dibbling wheel.
1 086 511 (United States). Corn planter.
1 087 010 (United Srates). Cotton planter.

Mowers, reapers and harvesters.

461 372 (France). Attachment for raising the ears in harvesters and similar machines.
461 380 (France). Mower.
463 365 (France). Automatic mower.
269 353 (Germany). Three-wheeled sheaf binder.

24 872 (Germany). Harvesting machine.
25 152 (United Kingdom). Reaping or mowing machine.

Machines for lifting root crops.

64 050 (Austria). Potato harvester.
64 300 (Austria). Potato harvester.
262 259 (Belgium). Apparatus for topping beets.
262 271 (Belgium) Device for automatic raising and lowering of beet lifters.
261 789 (Belgium). Device for topping, lifting and carting beets, etc., and at the same time ploughing the soil.
24 737 (United Kingdom). Potato harvesters.
1 086 631 (United States). Beet harvesters.
1 086 563 (United Kingdom). Potato harvest machine.

Other agricultural machines and implements.

461 113 (France). Appliance for bimetallic sprayers.
461 403 (France). Apparatus for removing the upper layer from honey-combs.
460 417 (France) Instrument for cutting bunches of grapes.
460 659 (France). Forage drier.
269 354 (Germany). Hay tedder convertible into swathe rake.
269 482 (Germany). Differential steering for fore-carriages.
269 573 (Germany). Hummeller.
270 841 (Germany). Straw press binder with two pincer-like groups of arms working together.
271 753 (Germany). Automatic wire binder for straw presses and the like.
25 000 (United Kingdom). Cow milkers.
25 063 (United Kingdom). Grinding, crushing and cleaning grain.
25 275 (United Kingdom). Fermenting vats.
25 279 (United Kingdom). Hedge trimmers.
24 595 (United Kingdom). Cooling milk.
24 601 (United Kingdom). Separating apples.
24 614 (United Kingdom). Cracking nuts, seeds, etc.
24 771 (United Kingdom). Protecting orchards from frost.
24 816 (United Kingdom). Destroying weeds.
1 086 597 (United States). Hay loader.

RURAL ECONOMICS.

375 – **A Farm Management Survey of Three Representative Areas in Indiana, Illinois and Iowa.** — THOMSON, E. H. and DIXON, H. M. in *Bulletin of the U. S. Department of Agriculture*, No. 41, pp. 42. Washington, January 14, 1914.

In the year 1911 the office of Farm Management of the Bureau of Plant Industry, United States Department of Agriculture, made a farm management survey of 700 farms, the results of which are given and discussed in the present paper. Three districts, one each in Indiana, Illinois and Iowa, were selected for the farm management study; in choosing the areas an effort was made to have as uniform farm conditions as possible in each region and representative of the agricultural conditions prevailing over a large area. The farms examined were 277 in the first State and 196 and 227 in the other two States respectively.

In Illinois and Indiana weather conditions were about the average, while in Iowa, owing to a drought in early summer, the results were about

20 per cent below the average. The data were obtained by having trained investigators to visit the farmers personally.

The writers examined first the effect of the form of management, and divided the farms into four groups: those operated by the owners, those worked by tenants, those owned by a farmer who rented additional land and those rented from two or more landlords, they then calculated the incomes yielded by these various groups. (See Table I).

The labour income of farmers who operate their own farms is very moderate. For the amount invested the tenant's income is very much greater than that of the farm owner, though the absolute total income of the latter is greater owing to the interest on the large capital. The evidence is unmistakeable that the man with small capital should rent rather than buy a farm. The third group, namely of owners who rent additional land, show a better labour income than that of owners; this is explained by the fact that they utilize better their labour and their teams and receive greater returns without any appreaciable increase in investment. Calculating the rate of interest on the capital invested in farms operated by the owners at 3.5 per cent. instead of 5 per cent., the former being in fact the rate of interest obtained by the owner of rented farms, an average labour income of $870 to the operator, whether owner or tenant, may be expected. The farms in the three States yield for an average size of 175 acres an average labour income of $870 and an interest of 3.5 per cent. on the capital invested.

The labour income of farmers who run their own farms varies from below $500 to upwards of $2000. In order to show that the causes of these great differences depend mostly upon the varying activity of the farmer and less upon the size of the farm and the amount of capital invested, the farms are grouped in Table II according to the labour income they yield, compared with the capital, area, expenses, and receipts per acre.

From Table II it will be seen that the largest farms and the greatest capitals are in the hands of those farmers who have obtained on the one hand the best results, and on the other the worst.

If on the contrary the capitals of the tenants are compared with their labour income, it appears that almost without exception the tenant's income is in direct proportion to the sum he has invested, while the amount of capital has no connection with the rate of interest on the capital invested by the owner. (See Table III).

In order to study the influence of the size of the farm on the cost of labour, the writers group the 700 farms according to size and calculate for each the cost of labour, the number of draught horses, the crop area per horse and the capital invested in machinery. (See Table IV).

On farms of 40 acres and less the cost of labour is over $10 per crop-acre. On all farms above 120 acres the cost is less than $6 per crop-acre. Large farms also utilize better their horse labour; on farms of 240 acres one horse works two and one-half times as much land as on a 40 acre farm. The same laws which govern the use of farm labour apply

to machinery ; thus, while in the smallest farms the value of the machinery is $5.4 per crop-acre, in the largest it ranges from $2.15 to $1.42. That labour in the larger farms, in spite of the greater area per unit of labour,

TABLE I.

	Operated by owners				Tenants		
	Indiana	Illinois	Iowa	Average	Indiana	Illinois	Iowa
Number of farms	123	73	77	total 273	83	71	9
Average area . . . . . acres	105	253	176	178	128	202	18
Average capital . . . . . $	17 535	51 091	23 193	30 606	1 758	2 867	2 66
Receipts . . . . . »	1 876	5 042	2 308	3 076	1 335	2 257	1 60
Expenses . . . . . »	689	1 866	858	1 138	492	975	75
Farm income . . . . . »	1 187	3 176	1 450	1 938	843	1 282	85
Interest at 5 p. cent . . . . . »	877	2 554	1 159	1 530	88	143	13
Owner's labour income . . . . . »	310	622	291	408	755	1 139	71

TABLE II.

Labour income	Number of farms	Average size — acres	Average crop area — acres	Average capital — $	Real estate
—$500 and more	26	267	199	46 582	89.7
—$499 to —$200	23	160	117	25 933	89.2
—$199 to $0	40	102	77	16 883	88.5
$ 1 to $ 200	53	120	95	19 753	89.6
$ 201 to $ 400	34	139	96	20 435	86.7
$ 401 to $ 600	23	161	118	27 986	86.8
$ 601 to $ 800	20	184	140	30 158	86.6
$ 801 to $1000	13	217	160	35 082	89.8
$1001 to $1500	19	201	169	32 658	88.2
$1501 to $2000	10	249	179	46 573	83.7
over $2000	12	330	140	55 625	85.1

is utilized with about the same intensity as in the small farms is shown by Table V, in which the relation of the farm to the yield of the various crops is given.

TABLE I.

perated by tenants					Operated by owners renting additional land			
	Landlords							
verage	Indiana	Illinois	Iowa	Average	Indiana	Illinois	Iowa	Average
al 247	83	71	93	total 247	56	36	37	total 129
172	128	202	187	172	—	—	—	105 + 78
2 431	18 423	36 479	20 728	25 210	11 321	32 382	17 829	20 510
1 732	1 002	1 538	1 014	1 185	1 780	4 279	2 228	2 762
740	351	213	354	306	742	1 599	887	1 076
992	651	1 325	660	879	1 038	2 680	1 341	1 68f
122	3.53 %	3.64 %	3.19 %	3.5 %	566	1 619	891	1 025
870	—	—	—	—	472	1 061	450	665

TABLE II.

e in			Distribution per acre				
hl-ry	Stock	Supplies	Receipts — $	Expenses — $	Farm income — $	Interest — $	Labour income — $
2	6.7	2.4	10.98	5.97	5.01	8.74	—3.73
1	7.4	2.3	12.02	5.92	6.10	8.16	— 2.06
2	7.7	2.6	12.94	5.53	7.41	8.30	—0.89
4	6.7	2.3	14.84	5.70	9.14	8.31	0.83
7	9.1	2.5	14.98	5.37	9.61	7.42	2.19
0	8.2	3.0	17.80	5.79	12.01	8.78	3.23
8	8.9	3.2	17.13	5.16	11.97	8.22	3.75
2	6.9	2.1	16.77	4.51	12.26	8.14	4.12
4	8.0	2.4	19.18	5.00	14.18	8.23	5.95
5	11.7	3.6	25.79	9.60	16.19	9.31	6.88
0	11.0	2.9	25.46	7.14	18.32	8.46	9.86

TABLE III.

	Tenant's capital $	Number of farms	Tenant's average capital $	Tenant's labour income $	Landlord's average capital $	Landlord's income on investment per cent
Indiana	500 and less	5	324	328	9 492	4.0
	501 to 1 000	13	750	312	9 940	2.9
	1 001 to 1 500	18	1 263	506	12 829	3.1
	1 501 to 2 000	19	1 726	765	17 679	3.0
	2 001 to 3 000	18	2 381	1 051	22 130	3.6
	3 001 to 4 000	8	3 324	1 217	34 904	4.0
	4 001 to 6 000	2	4 770	2 322	54 088	4.4
	Total or average	83	1 758	755	18 425	3.5
Illinois	501 to 1 000	4	871	429	10 031	2.7
	1 001 to 1 500	10	1 262	614	23 737	3.5
	1 501 to 2 000	15	1 733	709	29 703	4.1
	2 001 to 3 000	18	2 482	1 054	36 948	4.05
	3 001 to 4 000	15	3 493	1 085	42 898	3.3
	4 601 to 6 000	4	4 828	1 732	50 950	3.6
	6 000 and over	5	9 011	4 117	70 750	3.1
	Total or average	71	2 867	1 139	36 479	3.6
Iowa	501 to 1 000	4	776	272	8 568	3.2
	1 001 to 1 500	16	1 288	387	13 808	3.0
	1 501 to 2 000	14	1 816	490	16 971	2.8
	2 001 to 4 000	30	1 455	639	19 374	3.0
	3 001 to 4 000	18	3 428	983	25 027	3.2
	4 001 to 6 000	8	4 825	1 334	31 490	3.2
	6 001 and over	3	8 303	1 641	50 412	4.7
	Total or average	93	2 667	716	20 728	3.2
Total or average for the three States.		247	2 419	850	24 482	3.4

TABLE IV.

Area	Number of farms	Average Crop area * — acres	Cost of labour per crop-acre	Average number of work horses	Crop area per horse — acres	Value of machinery	
						Total per farm	per crop-acre
40 acres united . . .	45	26.4	$ 10.08	2.8	9.4	$ 133	$ 5.04
41 to 80 acres . .	114	56.7	7.28	3.6	15.7	241	4.25
81 » 120 »	120	86.0	5.57	4.5	19.1	279	3.24
121 » 160 »	130	122.4	4.89	5.8	21.1	345	2.82
161 » 200 »	93	143.4	4.74	6.6	21.7	413	2.88
201 » 240 »	75	184.9	4.69	7.8	23.7	452	2.44
241 » 280 »	35	211.2	4.40	8.4	25.1	718	3.40
281 » 320 »	37	233.8	3.98	9.5	24.6	561	2.40
321 » 400 »	30	298.0	3.88	10.8	27.6	747	2.51
401 » 560 »	12	368.6	3.88	13.1	28.1	690	1.87
561 » 720 »	5	555.4	4.41	19.4	28.6	790	1.42
721 » 1250 »	4	612.0	5.29	19.0	32.2	1 313	2.15
Total or average . . .	700	142.8	4.63	—	—	383	2.69

(*) All tillable land except permanent pasture.

TABLE V.

Size of farms — acres	Indiana				Illinois				Iowa			
	Number of farms	Yield per acre (bushels)			Number of farms	Yield per acre (bushels)			Number of farms	Yield per acre (bushels)		
		Maize	Oats	Wheat		Maize	Oats	Wheat		Maize	Oats	Wheat
80 and less	92	50.2	44.4	19.0	12	60.4	43.0	16.0	26	33.2	32.0	—
81 to 160	75	52.9	47.5	19.2	42	52.3	37.5	15.2	73	36.3	33.0	—
161 to 320	39	52.8	47.0	19.4	70	52.4	39.7	15.8	71	37.9	33.9	—
321 and over	—	—	—	—	20	55.6	40.5	17.8	—	—	—	—
Total or average	206	52.1	46.6	19.3	144	53.3	39.3	16.5	170	37.0	33.5	—

In order to study the effect of the different type of farming on the profits, both the farms run by their owners and those rented are divided into crop farms, and live-stock farms, according to the prevalence of cropping or raising live stock, and the labour income is recorded. (See Table VI).

TABLE VI.

Operated by:	State	Live stock farms					Crop farms				
		Number of farms	Area acres	Permanent pasture acres	Average capital $	Labour income $	Number of farms	Area acres	Permanent pasture acres	Average capital $	Labour income $
Owners	Indiana . . .	95	103.2	5.6	17 405	348	28	113.0	2.0	17 981	182
	Illinois . . .	32	284.2	66.3	58 487	1 588	41	229.4	24.4	45 319	— 131
	Iowa	67	181.2	40.1	23 775	329	10	140.9	17.1	19 296	34
	Total or average	194	189.5	37.3	33 222	755	79	161.1	14.5	27 532	28
Tenants	Indiana . . .	46	124	4	19 623	589	37	134	4	20 879	354
	Illinois	13	198	30	42 087	1 066	58	204	12	39 732	545
	Iowa	58	179	37	23 238	496	35	199	30	23 654	82
	Total or average	117	167	24	28 316	717	130	179	15.3	27 755	327

TABLE VII.

Operated by:	State	Live-stock farms				Crop farms			
		Number of farms	Yield per acre (bushels)			Number of farms	Yield per acre (bushels)		
			Maize	Oats	Wheat		Maize	Oats	Wheat
Owners	Indiana. . . .	95	52	47	20	28	51	49	18
	Illinois	32	60	43	17	41	51	36	18
	Iowa	67	37	35	20	10	42	35	—
	Total or average	194	50	42	19	79	48	40	18
Tenants	Indiana . . .	46	53	45	19	37	51	46	18
	Illinois . . .	13	59	42	15	58	51	39	15
	Iowa	58	35	31	17	35	37	34	—
	Total or average	117	49	39.3	17	130	46	39.6	16.5

The live stock farms, both those operated by the owners and those rented, yield a higher income than the crop farms. This is due primarily to two reasons: 1) That crop products, especially maize, fetch a higher price when fed to stock and converted into animal products than if sold on

the market ; 2) the live-stock man utilizes his labour throughout the year, which the crop farmers do not.

It is commonly supposed that the live-stock farmers make greater profits owing to much better crop yields. That such is not the case is shown by Table VII.

Of the 247 farms operated by tenants, 58 were held on the cash-rent system and 189 on the share-rent system. A comparison of the income of the tenant and of the owner with both these forms of rental is shown in Table VIII.

TABLE VIII.

State	Cash- rent system					Share- rent system				
	Number of farms	Tenant's capital	Tenant's labour income	Landlord's capital	Returns on capital invested, per cent	Number of farms	Tenant's capital	Tenant's labour income	Landlord's capital	Returns on capital invested, per cent
		$	$	$			$	$	$	
Indiana	14	2 272	864	14 968	3.42	69	1 654	733	19 126	3.55
Illinois	18	3 118	1 440	28 771	2.50	54	2 788	1 044	38 906	3.89
Iowa	27	2 942	689	19 114	2.37	66	2 555	727	21 388	3.49
Total or average	58	2 777	998	20 951	2.76	189	2 332	835	26 473	3.64

Those who leased their farms on a cash basis received a much lower return then those on a share basis, as the risks are taken in the latter case by the tenant. From the tenant's point of view, in good years the cash rent system is the most profitable, while in bad years the share-rent system is better. In the State of Iowa, in the year for which the records were taken, owing to unfavorable weather conditions the crops were about 20 per cent. below normal, and the cash-rent tenants made less than those on a share basis.

The writers lastly study the connetion between the age and education of the farmer and his profits. They find that, especially among tenants, the older farmers are the least successful. This is explained by the fact that the younger and more capable tenants soon acquire sufficient funds to become owners, whilst the least capable are never able to save enough money to buy a farm ; besides, landlords with good farms will not rent their land to them, and they are compelled to take the least desirable farms in the neighbourhood.

As for education, the investigations point to the fact that everywhere the men with the best training made the largest incomes.

376 – **Silesian Grazing Farms.** — WEITZ, G. in *Archiv für exakte Wirtschaftsforschung*, XII Supplement, 257 pp. Jena, 1913.

The writer gives in 13 complete descriptions a review of the natural and economic conditions of the management and arrangement, as well

Grazing farm	Year	Area of farm acres	Extent of pasture acres	Kind of stock (1)	Average number of grazing days	Increase of weight per head of large stock (2) lbs.	Head of large stock per acre for 150 days grazing	Produce per acre £ d s	Expense per acre £ s d	Net returns of pasture per acre £ s
XI (3)	1908	117.1	117.1	90 Y	117	2.82	0.352	2 5 1	3 2 8	—0 17
»	1909	»	»	168 Y	142	2.23	0.737	4 8 1	3 7 11	1 0
»	1910	»	»	179 Y	119.6	2.28	1.676	4 2 6	3 7 2	0 15
XII (3)	1910	215.4	215.4	286 A 21 F	139	2.26	0.78	4 12 6	1 17 3	2 15
»	1911	»	»	341 A 18 F	107	2.04	0.51	2 15 6	1 15 4	1 0
II	1906	667	52	46 A 7 F	175	2.60	0.72	4 5 8	1 0 6	3 5
»	1907	»	52	40 A	164	1.90	0.65	3 5 6	1 7 7	1 17 1
»	1908	»	47	53 C	121	—	0.91	4 7 3	1 19 0	2 8
»	1909	»	47	50 C 3 F	144	—	1.08	6 7 0	1 18 2	4 8 1
»	1910	»	62	53 C	143	—	0.83	4 15 11	2 1 2	2 14
VII	1910	840	68	Varying:	140	1.68	0.62	4 7 9	2 4 10	2 2 1
VIII	1909	840	29.5	C, Y	113	2.10	1.41	7 11 10	2 3 2	5 8
»	1910	»	»	H, F	79	—	1.03	—	1 17 6	—
V	1908	844.6	29.5	Mostly Y.	140	3.57	0.97	6 14 9	3 2 5	3 12
»	1909	»	»	also	190	2.33	1.13	7 1 4	2 14 5	4 6 1
»	1910	»	»	F, C	197	1.37	1.62	5 19 9	2 10 7	3 19
»	1911	»	»	A, B	190	1.43	1.40	5 6 9	3 2 6	2 4
VI	1910	1188	43.2	62 Y 2 F	153.5	2.44	0.96	6 2 9	1 12 2	4 10
X	1909	1218	84.5	50 Y	143.6	2.42	0.30	1 18 4	1 11 9	0 6
»	1910	»	131	140 Y	146.2	1.44	0.45	1 15 0	2 6 0	—0 11
XIII (3)	1910	61.0	61.0	84 Y 7 F	104	1.45	0.66	2 14 1	0 14 8	1 19
»	1911	»	»	83 Y 13 F	118	1.62	0.77	3 7 2	0 14 8	2 12

(1) Abbreviations in this column: Y = young cattle, A = cattle, F = foals, C = cows, H = horses, O = Ox
(2) One head of large stock = 1000 lbs. live-weight.
(3) XI, XII and XIII are cooperative pastures.

Value pasture r acre	Value of live stock	Total value per acre	Interest by net returns	Cost of production		Value of farm per acre	Net reeturns	Gross returns	Interest on value of farm by net returns
				of 1 lb. live weight	of 1 gal. of milk		of whole farm per acre		
s d	£ s d	£ s d	%	(Interest 4 % on capital invested) d	d	£ s d	£ s d	£ s d	%
11 6	2 16 3	30 7 9	—	9	—	30 7 9	—0 17 7	2 5 1	—
»	5 18 0	33 9 6	3.10	5	—	33 9 6	1 0 2	4 8 1	3.10
»	5 8 6	33 0 0	2.32	5 ¼	—	33 0 0	0 15 4	4 2 6	2.32
7 0	6 2 9	39 9 9	7.60	3	—	39 9 9	2 15 3	4 12 6	7.60
»	5 11 0	38 18 0	3.00	5	—	38 18 0	1 0 2	2 15 6	3.00
14 0	5 15 0	41 9 0	8.34	2 ¾	—	43 13 0	1 5 4	5 17 10	3.47
»	5 3 9	40 17 9	5.13	4	—	»	1 4 6	7 9 0	2.80
»	7 6 3	43 0 3	6.07	—	4.57	»	1 4 1	8 9 7	2.76
»	8 13 0	44 7 0	10.46	—	2.92	»	1 10 4	5 17 10	3.47
»	6 12 9	42 6 9	6.94	—	4.27	»	1 4 6	7 9 0	2.80
2 9	4 19 0	32 1 9	7.29	3	4.71	35 14 3	1 15 2	5 12 4	4.92
18 6	11 6 6	52 5 0	10.30	2 ½	3.11	31 14 9	1 9 2	—	4.59
»	8 5 3	49 3 9	—	—	—	»	1 9 2	—	4.59
11 0	7 15 9	63 6 9	5.71	3 ½	—	62 5 6	4 1 2	8 19 10	6.52
»	9 1 9	64 12 9	6.72	3 ¼	—	63 17 6	3 2 3	9 5 0	4.88
»	13 1 9	68 12 9	5.16	3 ¾	—	63 17 6	4 3 3	8 18 4	6.52
»	11 4 6	66 15 6	3.31	4 ¾	—	»	—	—	—
5 0	7 13 6	72 18 6	6.47	3	—	40 6 0	0 7 5	6 9 7	0.93
5 0	2 7 6	35 12 6	0.93	6 ¾	—	40 4 3	—0 10 9	2 6 7	—
»	3 12 9	36 17 9	—	9	—	41 13 3	0 11 3	2 17 11	1.35
16 3	5 6 0	38 2 3	5.70	3 ½	—	38 2 3	1 19 5	2 14 1	5.70
»	6 4 3	39 0 3	7.23	3	—	39 0 3	2 12 6	3 7 2	7.23

ills.

as of the profitableness, of ten farms with grazing land and of three cooperative pastures, situated in different parts of Silesia; in these descriptions the grazing industry in its installation, operation and profitableness, is specially considered.

Lastly, with the aid of numerous comparative tables, he discusses the characters common to all these farms, and the points in which they differ from each other. The most important results of this investigations are given in the table on pages 528 and 529, for nine of the farms.

377 – **Two years' Results from the Cooperative Pasture at Coswig, in Anhalt (Germany).** — Butz *Landwirtschaftlich Umschau*, Year 6, No. 8, pp. 171-172. Magdeburg, February 20, 1914.

In the spring of 1911, the Coswig Cooperative Pasture Association was founded, and rented 28.64 acres of meadow land at 52*s* 4*d* per acre to use as a grazing ground for young stock. The pasture was divided into three almost equal enclosures separated by wire fences and provided with a shed and dinking trough. The expenses of laying out the pasture were as follows:

	£	*s*	*d*
1. Stamp duties for the contract	1	7	0
2. Statutes, advertisements, notification,	1	5	8
3. Loss on lease of pasture in 1911	14	1	3
4. Chemical fertilizers	22	14	5
5. Fencing materials	63	2	1
6. Shed	38	5	3
7. Drinking trough	6	4	6
8. Wages of labourers	23	2	5
9. Other wages	11	3	1
Total expenses	£ 181	5	8

The pasture was opened in May 1912 and 12 foals and 37 heifers were turned in; in 1913, 19 foals and 20 heifers were put out to grass. If a foal's grazing day is reckoned as equal to 1 ¼ of a heifers' grazing day the pasture provided 4752 heifer-grazing-days in 1912 and 6478 in 1913, and in addition, in the first year a hay crop worth £12. 18*s*.

The outlay during the two years was as follows:

	1912			1913		
	£	*s*	*d*	£	*s*	*d*
1. Lease	74	19	5	74	19	5
2. Manures	17	10	7	6	8	9
3. Amortisation of capital (10 % on £ 1815.*s*)	18	2	6	18	2	6
4. Interest (4 %)	7	5	0	6	10	6
5. Wages of stockman	6	16	0	9	11	4
6. Labourer's wages	—	—	—	3	3	9
1. Sundries	1	12	10	4	11	9
Total expenditure	£ 126	6	4	£ 123	8	0
Less hay sold	12	18	0	—	—	—
	£ 113	8	4	£ 123	8	0
The grazing-day therefore cost	5.73 *d*			4.57 *d*		

378 – **The Cost of Milk Production in the Counties of Kent and Surrey.** — GARRAD, G. H. and MACKINTOSH, J. in *South-Eastern Agricultural College, Wye, Second Report on the Cost of Food in the Production of Milk in the Counties of Kent and Surrey*, 1912, pp. 1-28. London, 1913.

An enquiry into the cost of milk production which was instituted in 1912 by the South-Eastern Agricultural College, Wye, extended over 20 farms in the counties of Kent and Surrey and a total of about 730 cows. In calculating the cost of the milk production, only the value of the food fed to the animals was considered, *i. e.* no allowance was made for attendance, etc. The necessary data for the calculations — the cost of the food and the milk yields — were collected by an inspector who visited the farms once a month for this purpose. The bought food was reckoned at market price, and homegrown produce at the cost of production, while the grazing value was calculated according to the rent of the various meadows.

The year was divided into three periods: winter (January-March), summer (April-October) and autumn (November and December): the average milk yield of each period was taken, and the cost of the daily food per cow and per gallon of milk was estimated.

The results are tabulated, and the writer discusses the differences observed from one farm to another. A summary of the results is given in the following table:

Period	Average daily milk yield per cow. gall.	Average cost of food per cow. per day	Cost of food per gallon of milk
Winter (January to March)	2.11	14.68 *d.*	6.96 *d.*
Summer (April to October)	2.24	5.70 *d.*	2.54 *d.*
Autumn (November and December)	2.05	11.90 *d.*	5.80 *d.*
Annual average . . .	2.17	9.37 *d.*	4.32 *d.*

379 – **The Depopulation of the Country.** — LAUR, E. in *Fühlings Landwirtschaftliche Zeitung*, Year 63, Part. 1, pp. 1-22 and Part 2, pp. 53-63. Stuttgart, January 1 and 15, 1914.

The writer makes use of the official census returns of about 20 different States for a general review of the changes in the rural population of these countries during the period from 1880 to about 1900. He compares the increase of population of towns (communities with from 2000 to 5000 inhabitants) with the increase or decrease of the rural population, and calculates the change in the percentage of both in the total population. If the numbers of inhabitants of the first census (which was taken in most States in 1880) be added together and compared with the sum of the second census (which, with one exception, refers to the year 1900 or a later year) the following figures are obtained:

		In 1880	In 1900 and later	Increase
Total population		273 550 133	351 831 079	78 280 946
Town communities	Population	108 694 959	173 469 479	64 774 520
	Percentage	39.73	49.30	59.59
Rural communities	Population	164 855 174	178 361 600	13 506 426
	Percentage	60.27	50.70	8.19

The populations of town and country have both of them increased, but the towns show an increase of 59.59 per cent. and the country of only 8.19 per cent. The decrease of the percentage of rural population in the whole population

TABLE I.

	Increase or decrease of			Percentage to total population			
				Town population		Rural population	
	rural population	town population	total population	about 1880	about 1900	about 1880	about 1900
Servia	+ 1.98	+ 4.22	+ 2.236	11.4	15.0	88.6	85.0
Greece	+ 1.69	+ 3.36	+ 2.025	20.2	25.0	79.8	75.0
United States	+ 1.415	+ 5.98	+ 2.59	25.8	37.3	74.2	62.7
Rumania	+ 1.3075	+ 2.57	+ 1.495	14.8	18.8	85.2	81.2
Hungary	+ 0.955	+ 2.045	+ 1.08	14.6	16.7	85.4	83.3
Portugal	+ 0.586	+ 1.564	+ 0.859	29.1	32.8	70.9	67.2
Chile	+ 0.54	+ 3.13	+ 1.425	34.2	43.3	65.8	56.7
Denmark	+ 0.52	+ 3.26	+ 1.29	28.0	40.2	72.0	59.8
Switzerland	+ 0.445	+ 2.90	+ 0.855	16.6	22.4	83.4	77.6
Canada	+ 0.405	+ 4.33	+ 1.21	20.5	30.9	79.5	69.1
Belgium	+ 0.38	+ 2.31	+ 1.207	43.1	53.2	56.9	46.8
Norway	+ 0.376	+ 2.35	+ 0.80	21.5	29.4	78.5	70,6
Sweden	+ 0.236	+ 3.22	+ 0.686	15.1	24.4	84.9	75.6
Austria	+ 0.18	+ 2.62	+ 0.905	29.6	38.2	70.4	61.8
Germany	— 0.104	+ 3.44	+ 1.36	41.4	57.4	58.6	42.6
England	— 0.17	+ 1.99	+ 1.293	67.9	78.1	32.1	21.9
Scotland	— 0.27	+ 1.76	+ 0.985	62.0	69.8	38.0	30.2
France	— 0.304	+ 1.05	+ 0.21	34.8	42.1	65.2	57.9
Italy	— 0.425	+ 1.02	+ 0.79	84.2	87.5	15.8	12.5
Ireland	— 1.09	+ 0.56	— 0.69	24.0	31.0	76.0	69.0

does not always signify that the population of the country has absolutely diminished. In reality in many States, especially in the so-called agricultural States, it has increased, but nowhere in the same measure as the town population. Only in some of the old civilized countries can a depopulation of the country be spoken of, as only they show an absolute decrease of rural population. In the Table I the various States are arranged according to the yearly increase or decrease of the rural population in percentages of the population of the year 1880. For comparison, the increase and decrease of the town population and of the total population, as well as the variations of the percentage of town and country population, are given also.

All the States show an increase of town population, which in most cases is in excess of the natural increase of the population. In all the States the percentage of the rural population in the whole population has diminished.

The writer then examines, in those States for which data are available, the changes in the agricultural population, in the working agricultural population, in the numbers of independent farmers and in those of farm employees. The results of this investigation are given in Table II.

TABLE II.

State	Percentage of yearly increase or decrease			
	of total agricultural population	of working agricultural popnlation	of independent farmers	of agrieultural employees
Bulgaria	+ 1.60	—	— 1.30	+ 4.23
Austria	+ 0.52	— 0.31	— 0.43	— 2.50
Denmark	+ 0.44	—	+ 2.74	— 0.69
Hungary	+ 0.39	+ 1.65	— 0.25	+ 0.62
Belgium	+ 0.04	— 0.68	+ 0.23	— 1.22
Switzerland	— 0.30	— 0.66	+ 0.05	— 0.73
Norway	— 0.33	— 0.71	—	—
Germany	— 0.38	+ 0.75	+ 0.33	— 0.64
France	— 0.46	+ 0.41	+ 0.42	— 0.63
Great Britain and Ireland	—	— 0.65	— 0.45	— 0.81
United States	—	+ 2.97	+ 0.74	—

With the exception of Austria, the agricultural populations have everywhere increased less rapidly or have decreased more than the total agricultural population. The agricultural population evidently loses more members by emigration to the towns and by change of occupation than the other callings in the country. In most of the old civilized countries there is an absolute decrease of the agricultural population, and only in the total agricultural population, and only in the agricultural States is there a nota-

ble increase of the numbers of persons engaged in agriculture. Nevertheless, the number of independent farmers has on the whole increased more or diminished less than the total agricultural population. The emigration of the agricultural classes has thus been the cause of a diminution of the existing labour in individual farms, rather than of a decrease in the number of independent farmers.

In concluding the writer treats of the causes of the emigration of the inhabitants of the country towards the towns, and of the means of retaining a numerous agricultural population. He considers the best means to be the prevalence of peasant farms and consequently maintainance, increase and improvement of the peasant classes; only the gradual conversion of the land into peasant farms will permanently solve the problem of the scarcity of agricultural labour.

AGRICULTURAL INDUSTRIES.

DAIRYING.

380 – **Titration of Milk with Alcohol at Different Degrees of Concentration.** — Lohnis F. in *Molkerei-Zeitung*. Year 28, No. 9 pp. 158-155. Hildesheim, January 30, 1914.

The alcohol test, as it is generally practised at present, that is to say by mixing equal volumes of milk and 68 or 70 per cent alcohol (by volume), is undoubtedly valuable for recognizing milk of abnormal quality, or such as, owing to its high content of bacteria, is barely utilizable. On the other hand the normal milk of commerce does not always coagulate with this test, even when its bacterial content is very high. Attempts have therefore been made to render the method more exact, and among other suggestions that of doubling the quantity of alcohol has been made.

Recent experiments conducted by the writer with 90 per cent alcohol at once gave highly encouraging results, whilst tests with 70 per cent alcohol at first failed completely. With milk rich in bacteria the writer had, it is true, satisfactory results even with 70 per cent alcohol. Eighty per cent alcohol gave, in general, still better results. Two cc. of milk at 15 to 20° C. (59 to 68° F.) were always taken for the titration tests with the various alcohols. The number of cc. used is called by the writer the " alcohol number " (Alkoholzahl) of the titrated milk. The number in brackets (90, 80, 70, etc.) indicates the concentration of the alcohol used in percentages by volume (Tralles degrees).

The operation of titrating presents no difficulty. The final point is best found by pouring the 2 cc. of milk into a small beaker which is kept somewhat slanting and shaking it gently over a black background. If the alcohol is allowed to fall carefully drop by drop into the milk the beginning of coagulation is recognized without difficulty, especialy where the milk only forms a shallow layer at the bottom. Duplicate experiments usnally agree within 0.1 cc.; however, even differences of 0.2 or 0.3 would not generally be of any great importance. In the first titration experiments made by the writer 0.05 cc. was the greatest difference obtained in duplicate tests.

Quite fresh milk of many cows shows consistently high alcohol numbers over a lenth of time. For other cows, on the contrary, these numbers are consistently low. It is not rare, however, for the alcohol number to vary from day to day. This seems to depend, partly at least, upon the weather, and to increase and diminish with the temperature of the air. In winter the alcohol numbers have always been found surprisingly low. A mixture of milk from several cows gives more stable alcohol numbers than that from only one cow. The first milk obtained in milking usually gives alcohol numbers (90) higher by 0.5 to 1 cc. than that obtained towards the end. Nevertheless, in 25 per cent. of the cases the reverse was observed. The handling of the milk (scales, filter, cooler, etc.) most frequently has the effect of slightly lowering the alcohol number. The alcohol numbers of milk that had been kept some time increased or diminished according to the prevalence of the acid or curdling bacteria or of those which decompose protein.

Out of 73 mixtures of milk in which the writer determined the alcohol number, only four yielded divergent results. From the other results the following generalisation could be made:

Low	bacterial content:	Upwards of 4 cc. of alcohol	(80)
Average	» »	2 to 4 cc. »	»
High	» »	less than 2 cc. »	»
Very high	» »	» » 2 cc. »	(70)

If these numbers be compared with the values determined by the methyl blue test (according to the method recommenced by Orla Jensen and Chr. Barthel), it will be seen that there is no noticeable difference. The writer prefers the alcohol test because it allows the low bacterial content to be recognised (less than 100 000 per cc.) and the keeping qualities of the milk to be determined.

Where the milk tested was examined on the second day, the following results were obtained:

	Alcohol number (80)	
	1st day	2st day
2 900 to 41 350 bacterias per cc . .	4.3 to 7.3	4.8 to 6.1
200 000 to 4 000 000 » » » . .	2.2 » 5.8	1.6 » 3.1
Above 4 000 000 » » » . .	1.0 » 1.8	less than 1.

381 – **The Bactericidal Properties of Milk at Low Temperatures.** — De Rossi, Gino in *Rivista Scientifica del Latte*, Year 3, Part 6, pp. 90-91. Reggio-Emilia, December 1913.

Experiments were made with the object of ascertaining the behaviour of the bacteria in milk when the latter was placed in an ice-cellar immediately it was drawn, so that it was cooled nearly to freezing point. It was found that the few germs originally contained in the milk diminished so rapidly through the action of the low temperature that in a few days the milk was almost sterile. When the milk before cooling contained many bacteria, their numbers were considerably reduced by the cold. They began to diminish

within the first few hours, and continued to do so, reaching a minimum generaly by the sixth or seventh day, after which a new increase frequently set in. This fact can only be explained by the supposition that certain bacteria are not injured by the cold and that they can multiply at very low temperatures.

In another series of experiments, the writer investigated the behaviour of certain bacteria expressly added to the milk, especially germs of infectious d seases which are believed to the spread by milk. It was found that by the action of cold, cholera and diphtheria bacilli i troduced into the milk in large quantities were completely destroyed in an average time of 24 hours; but it required three or four days for typhus and tuberculosis bacilli to be destroyed or even much weakened

It thus appears that milk at low temperatures not only impedes the multiplication of bacteria, but diminishes their numbers, especially in the case of germs injurious to health. But a long storage of milk at freezing-point is not to be recommended, as the destruction of disease germs is accompanied by the development of a number of other bacteria, which though intrinsically harmless make the milk unfit for food.

382 **The Question of the Formation of Fat from Protein during the Ripening of Cheese.** — KONDO, KURO in *Biochemische Zeitschrift*, Vol. 59, Nos. 1 and 2, pp. 113 165. Berlin, January 22, 1914.

The writer prepared Cheddar cheese exactly according to the recipe, and estimated its fat content in the fresh condition, as well as during and after ripening, in order to ascertain whether fat was built up from protein during the maturing process. To this end, he divided each fresh cheese into four equal portions. He at once determined the fat content of one piece, and put the others aside to ripen, one in the air, one in an atmosphere of carbonic acid, and the last in an atmosphere of hydrogen. In addition, some of the cheeses were covered with paraffin and placed in the open air to ripen. From time to time the writer took a sample from each cheese and tested its fat content by the Kumagawa-Suto soap method (1). At the end of the experiment some fat determinations were also carried out by the ether extraction method for comparison.

The writer draws the following conclusions from the results of his experiments :

1. When cheese ripens in the air, there is always a decrease in its fat content. The decrease is not equal in similarly made cheeses ; it usually begins ten days after storing, and increases with time. The amount of the diminution of the fat does not appear to depend solely upon the time of keeping, but very probably is also due to the physical pecularities of the cheese and to the temperature of the store-room.

2. The decrease in the fat content observed in cheese ripened in the air is caused by the presence of a mould which grows upon the surface of the

(1) A description of this method is to be fouud in Abderhalden's « Hendbuch der, biochemischen Arbeits-methoden » Vol. 5, pp. 477-488, publised by Messrs. I Springer Berlin.

cheese ; the fat consuming propensity of this fungus was first established by Kumagawa and Ohta. The growth of the fungus usually begins after ten days of storing and increases so much with time, that the whole surface of the cheese is eventually covered with whitish fungus hyphae. The decrease in the fat content entirely corresponds to the growth of the fungus.

3. In the case of paraffined cheeses exposed to the air the decreases of the fat content is almost as great as in unparaffined ones. This proves that the oxygen of the air finds its way through the thin layer of wax and reaches the surface of the cheeses, thus permitting the germination of the fungus spores. If the cheeses are, however, dipped repeatedly in the paraffin bath from the beginning of the experiment, the fungus makes very little growth during the storage, and the decrease in fat is much less. The writer did not, however succeed in entirely checking the growth of the fungus by treating the cheese with paraffin.

4. The ripening of the cheese and the diminution in its fat content are two entirely separate processes ; therefore the cheese need not necessarily always become poorer in fat through ripening. This is proved by the fact that there is no loss of fat when the cheese is ripened in the absence of atmospheric oxygen, under which condition it ripens as satisfactorily as in the air. Further, it was found that the non precipitating nitrogen always increased with the time of keeping and at the cost of the precipitating nitrogen ; this occurred to the same extent whether the cheeses were kept in air, or in atmospheres of carbonic acid or hydrogen.

5. Aerobic bacteria are thus indispensable to the ripening of cheese, although it has not yet been ascertained whether this process depends upon anaerobic microorganisms, or whether it is not solely due to the presence in the cheese of pre-existing ferments. The writer inclines to the latter view.

6. The experiments on the lipoid content of the cheese which were carried out with the alcohol-ether extract method on the one hand, and with the soap method on the other, showed that the amount obtained by the former was throughout from 2 to 3 per cent. larger in the case of ripe cheese than in the fresh product, while with the latter method, the corresponding values were decreased from 2 to 3 per cent. The increase in the ether-extract in the cheese-ripening was, however, far less than the writer had expected.

7. It can thus be stated that under no circumstances does an increase of the fat content take place during te ripening of cheese, and consequently there can be no formation of fat from protein. The amount of fat in cheese ripened in the air continually decreases, owing to the growth of mould, of while it remains unchanged if the ripening process takes place in the absence of oxygen.

383 – **The Baking Qualities of Flour as influenced by Certain Chemical Substances, Milling By- products and Germination of the Wheat.** — WILLARD, J. T. and SWANSON, C. O. in *Kansas State College of Agriculture, Bulletin* No. 190, pp. 237-285 + plates I-IX. Manhattan, Kansas, October 1913. BREAD MAKING INDUSTRY.

The dependence of the physical properties of gluten on the presence of certain substances in small amounts suggested the following experiments

TABLE I.

Total time in minutes for rising as affected by different substances.

Substance	Minimum quantity in grams	Number of times minimum quantity					
		0	1	2	4	8	16
Peptones	0.4	180	172	166	158	153	149
Glycocoll. $CH_2(NH_2)COOH$	0.1	172	164	160	166	165	162
Leucin $(CH_3)_2CH\,CH_2\,CH(NH_2)\,COOH$	0.025	170	166	157	167	162	160
Aspartic acid $COCH.\,CH_2.\,CH(NH_2)\,COOH$	0.1	160	151	142	125	130	135
Asparagin $CONH_2\,CH_2\,CH(NH_2)\,COOH + H_2O$	0.1	176	161	149	149	144	142
Ammonium acetate $CH_3.\,COON\,H_4$	0.1	174	161	150	144	136	138
Ammonium tartrate $NH_4\,OOC.\,CHOH.\,CHOH.\,COONH_4$	0.1	169	159	149	143	150	147
Ammonium chloride $NH_4\,Cl$	0.025	157	155	155	148	142	138
Ammonium phosphate $(NH_4)_2\,HPO_4$	0.1	162	159	152	150	156	159
Sodium phosphate $Na_2\,HPO_4 + 12H_2O$	0.4	170	166	155	154	161	170
Sodium bicarbonate $NaHCo_3$	0.1	176	175	170	186	184	180
Sodium formate $H.\,COONa + H_2O$	0.1	157	151	157	165	148	174
Potassium nitrate KNO_3	0.1	161	154	156	152	162	159
Bran extract, cold extraction	2.5 [1]	166	156	148	145	128	131
Bran extract, cold extraction filtered	2.5 [1]	161	152	145	143	135	137
Bran extract, hot extraction	2.5 [1]	167	164	147	144	156	164
Wheat scourings, extract I	2.5 [1]	135	127	118	119	118	113
Wheat scourings, extract II	2.5 [1]	176	171	161	157	158	163
Flour from germinated wheat	25.0	162	140	118	113	133	143
Flour from germinated wheat	9.0	165	160	152	148	144	113
Cold bran extract from germinated wheat	2.5 [1]	170	163	156	148	159	173
Boiled bran extract from germinated wheat	2.5 [1]	127	128	135	131	208	192
Cold extract from shorts of germinated wheat	2.5 [1]	153	133	125	121	115	163

[1] Weights of material extracted.

on the effect of different quantities of the products of protein metabolism, inorganic salts, and extract of bran and shorts, on the baking qualities of flour. It is probable that hydrolysis of the proteins takes place during the growth of yeast in the flour and that the products thus liberated play an important part in the growth of the yeast and affect the physical properties of the gluten.

The yeast used in these experiments was obtained fresh from a local baker and stored in a dry refrigerator. It was thoroughly mixed and weighed out into glass-stoppered bottles in 10 gm. portions. Unbleached flour was heated to a temperature of 35° C. and used in 300 gram portions. The same amount of water was used in each test, *viz.* 165 cc., and the required quantity

TABLE II.

Rise in the oven during baking as affected by different substances.

Substance added	Minimum quantity grams	Number of times minimum quantity					
		0	1	2	4	8	16
Peptones	0.4	4.4	4.8	4.6	3.9	3.9	4.2
Glycocoll	0.1	4.3	3.9	2.5	3.1	3.5	1.8
Leucin	0.025	4.5	4.5	4.0	3.5	5.1	4.5
Aspartic acid	0.1	5.5	5.3	4.9	4.9	5.5	5.5
Asparagin	0.1	5.1	5.2	5.1	4.8	3.8	4.6
Ammonium acetate	0.1	4.4	5.2	5.4	5.5	5.5	5.3
Ammonium tartrate	0.1	4.7	5.0	4.8	5.2	5.6	4.4
Ammonium chloride	0.025	3.3	4.2	3.8	5.3	6.1	6.1
Ammonium phosphate	0.1	5.0	5.4	5.5	5.4	5.4	5.4
Sodium phosphate	0.4	4.4	4.5	4.7	4.2	4.5	4.6
Sodium bicarbonate	0.1	4.0	4.5	4.0	2.6	2.5	2.0
Sodium formate	0.1	5.5	5.5	5.3	5.1	5.5	5.5
Potassium nitrate	0.1	5.0	4.8	4.1	4.5	5.1	5.1
Bran extract, cold extraction	2.5 (1)	4.9	4.9	4.7	5.3	5.4	5.6
Bran extract, cold extraction filtered	2.5 (1)	5.0	5.2	5.4	5.4	5.6	5.7
Bran extract, hot extraction	2.5 (1)	4.2	4.5	4.8	5.4	5.6	5.9
Wheat scourings, extract I	2.5 (1)	5.4	5.7	5.4	5.1	5.1	5.1
Wheat scourings, extract II	2.5 (1)	3.8	4.0	3.1	3.9	3.5	2.9
Flour from germinated wheat	25.0	4.9	5.4	5.6	4.0	4.2	1.1
Flour from germinated wheat	9.0	4.3	4.5	4.7	4.5	3.7	2.7
Cold bran extract from germinated wheat	2.5 (1)	4.3	3.4	4.0	5.0	4.3	4.5
Boiled bran extract from germinated wheat	2.5 (1)	3.6	5.6	5.1	5.5	5.4	4.8
Cold extract from the shorts of germinated wheat	2.5 (1)	5.2	5.7	5.6	5.6	5.9	5.8

(1) Weights of material extracted.

of the substance added with 15 grams of sugar and dissolved in a beaker at 35° C. The yeast was mixed with this solution and allowed to ferment for 30 minutes at 35° C. before mixing with the flour. The dough was made by placing 200 grams of the warmed flour and the yeast liquor in a Kœlner kneader and working it at full speed for 30 minutes, when the remainder of the flour was added and worked into the dough with a spatula for 5 minutes. It was then tested by placing it in a cylinder 30 cm. high and of such a diameter that 1 cm. in height corresponds to 100 cc. All the doughs had a volume of about 550 cc. and were allowed to rise to a volume of 1650. The time was noted and the dough worked lightly in the hands and allowed to rise again as far as possible. It was worked in the hands again and placed in

TABLE III.

Volume of loaf as affected by different substances, in cubic centimetres.

Substances added	Minimum quantity added	Number of times minimum quantity					
		0	1	2	4	8	16
Peptones	0.4	1380	1390	1370	1280	1300	1320
Glycocoll	0.1	1380	1330	1270	1240	1180	1180
Leucin	0.025	1380	1340	1280	1270	1360	1330
Aspartic acid	0.1	1460	1470	1460	1420	1500	1530
Asparagin	0.1	1440	1410	1380	1380	1300	1370
Ammonium acetate	0.1	1440	1490	1490	1500	1520	1500
Ammonium tartrate	0.1	1460	1470	1450	1520	1550	1400
Ammonium chloride	0.025	1300	1420	1260	1520	1690	1610
Ammonium phosphate	0.1	1470	1470	1470	1470	1440	1430
Sodium phosphate	0.4	1430	1450	1460	1400	1410	1420
Sodium bicarbonate	0.1	1330	1370	1350	1210	1170	1170
Sodium formate	0.1	1550	1530	1500	1470	1550	1500
Potassium nitrate	0.1	1500	1480	1440	1500	1520	1520
Bran extract, cold extraction	2.5 (1)	1480	1490	1410	1510	1520	1520
Bran extract, cold extraction filtered	2.5 (1)	1470	1500	1520	1550	1550	1550
Bran extract, hot extraction	2.5 (1)	1400	1420	1440	1520	1550	1560
Wheat scourings, extract I	2.5 (1)	1450	1480	1500	1520	1540	1490
Wheat scourings, extract II	2.5 (1)	1360	1460	1280	1360	1260	1190
Flour from germinated wheat	25.0	—	—	—	—	—	—
Flour from germinated wheat	9.0	1400	—	—	—	—	—
Cold bran extract from germinated wheat	2.5 (1)	1350	1290	1310	1360	1320	1350
Boiled bran extract from germinated wheat	2.5 (1)	1360	1460	1400	1500	1460	1420
Cold extract from the shorts of germinated wheat	2.5 (1)	1460	1530	1520	1520	1530	1500

(1) Weights of material extracted.

weighed baking-cans so constructed that, when placed in the oven, the dough presses against a circular disc attached to a vertical shaft regulated so as to ensure a uniform rise in all the samples before baking. The loaves were ther baked 35 minutes at 240° C. and the rise during this time was measured on the shaft. After cooling 30 minutes they were weighed and the volume determined by displacement of flax-seed

The results are tabutated in tables I, II and III. They show that:

1) Peptones and amino acids have an adverse effect on the physical qualities of the gluten. The dough was sticky and the texture of the loaf

much inferior to that of the control. Asparagin appears to stimulate the activity of the yeast, thus shortening the time of rising.

2) Inorganic salts in general improve the quality of the dough and bread, this effect being most marked in the case of ammonium chloride. This salt was very effective in such small quantities as $^1/_{300}$ to $^1/_{75}$ ounce per loaf, corresponding to the medicinal dose of this salt. Sodium bicarbonate has an injurious effect probably owing to its alkaline nature.

3) Extract of bran appears to stimulate the activity of the yeast, thus shortening the period of rising and increasing the rise during baking and the loaf volume. It had, however, an injurious effect on the texture of the loaf. The hot extract had less effect in shortening the time of rising, thus suggesting that the stimulating effects of the cold extract on the yeast are due to enzymes.

4) Ordinary bran mixed with flour gave loaves of poorer texture than those made with extracted bran and extract of bran used separately.

5) Extract of scourings (*i. e.* wheat dust and offal) shortened the period of fermentation and produced a sticky dough, thus resulting in a loaf of inferior texture. These effects were more pronounced with the products of germinated wheat. The dough was exceedingly difficult to handle and the loaf from the flour of germinated wheat fell to pieces.

Conclusions :

1. — The results obtained with ammonium chloride suggest further experiments to study its effect on the growth of yeast and to determine the quantity remaining in the bread.

2. — The constituents of the bran extract affecting the growth of yeast and the qualities of the gluten may have important chemical effects, which may account for the beneficial effects of Graham bread. Further experiments are suggested to determine the nature of these constituents and their effects on nutrition.

3. — It would appear that Graham bread might be improved by soaking the bran separately before mixing with the flour.

4. — The effect of extract of scourings appears to be due to the same cause as the effect of flour from germinated wheat, *i. e.* the amino-decomposition products of the wheat proteins.

5. — The methods of handling and storing grain and flour would appear to be capable of affecting its baking qualities to a considerable extent.

PLANT DISEASES

GENERAL INFORMATION.

LEGISLATIVE AND ADMINISTRATIVE MEASURES

384 – The Recommendations of the International Phytopathological Conference (Rome, February 24-March 4, 1914).

On February 24, 1914, a conference was held in Rome at the International Institute of Agriculture for the purpose of securing international cooperation in the control of plant diseases. The Conference, which was held under the auspices of the Institute, was summoned by the French Government in conjunction with the Italian Government ; the following States took part in it and sent their delegates :

ALGERIA :

LOUIS DOP, Vice-President of the International Institute.

R. MAIRE, Algiers.

AUSTRIA :

KARL PORTELE, Professor and Aulic Councillor, Ministry of Agriculture.

Chev. V. DE POZZI, Government Councillor, Delegate to the Permanent Committee of the International Institute.

BELGIUM :

T. VERNIEUWE, Director of the Horticultural Office, Ministry of Agriculture.

O. BOLLE, Delegate to the Permanent Committee of the International Institute.

P. MARCHAL, Botanist at the State Agricultural Institute, Gembloux.

CANADA :

H. G. GUSSOW, Dominion Botanist.

CHILE :

S. ALDUNATE, Minister Plenipotentiary, Delegate to the Permanent Committee of the International Institute.

CHINA :

SIU-KIU, Delegate to the Permanent Committee of the International Institute.

COSTA RICA :

R. MONTEALEGRE, Minister Plenipotentiary, Delegate to the Permanent Committee of the International Institute.

DENMARK :

A. DE OLDENBURG, Chargé d'affaires, Delegate to the Permanent Committee of the International Institute.

Dr. KÖLPIN RAVN, Royal Danish Veterinary and Agricultural College.

DOMINICA :

Count PASINI-FRASSONI.

FRANCE :

J. DEVELLE, Senator, Ex-Minister of Foreign Affairs and of Agriculture.

R. DE BILLY, Minister Plenipotentiary, Councillor at the French Embassy.

LOUIS-DOP, Vice-President of the International Institute.

L. MANGIN, Membre de l'Institut, Natural History Museum, Paris.

E. L. BOUVIER, Membre de l'Institut, Natural History Museum, Paris.

P. MARCHAL, Membre de l'Institut, Director of the Entomological Station, Paris.

E. SCHRIBAUX, Director of the Seed Testing Station, Paris.

E. FOEX, Sub-Director of the Station for Plant Pathology, Paris.

GERMANY :

Dr. T. MUELLER, Privy Councillor, Delegate to the Permanent Committee of the International Institute.

Dr. JUNG, Privy Councillor, Member of the Council of the Imperial Biological Institute, Dahlem.

Dr. BEHRENS, Privy Councillor, Director of the Imperial Biological Institute, Dahlem.

GREAT BRITAIN :

Lt.-Col. Sir DAVID PRAIN, Director of the Royal Botanic Gardens, Kew.

Sir JAMES WILSON, K. C. S. I., Delegate to the Permanent Committee of the International Institute.

A. G. L. ROGERS, Director of the Horticultural Section, Board of Agriculture.

GREECE :

Co. A. ISAAKIDES.

GUATEMALA :

T. MONTEFIORE, Consul General, Delegate to the Permanent Committee of the International Institute.

HUNGARY :

E. DE MIKLÓS, Secretary of State, Member of House of Magnates, Delegate to the Permanent Committee of the International Institute.

Dr. G. DE ISTVÁNFFY, Director of the Viticultural Institute, Budapest.

BRITISH INDIA :

H. MAXWELL LEFROY, Imperial College of Science and Technology, London.

IRELAND :

G. H. PETHYBRIDGE, Economic Botanist, Department of Agriculture and Technical Instruction, Ireland.

ITALY :

Marquis R. CAPPELLI, Vice-President of the Chamber of Deputies, President of the International Institute.

Prof. BATTISTA GRASSI, Senator, Membro dell'Academia dei Lincei.

ORESTE SAVINA, Consul General, Ministry of Foreign Affairs.

Prof. MICHELE CARLUCCI, Chief Inspector of viticulture and plant diseases.

Prof. ANTONIO BERLESE, Director of the Station for Agricultural Entomology, Florence.

Prof. G. CUBONI, Director of the Station for Plant Pathology, Rome.

JAPAN :

M. N. ITO, Attaché at the Embassy, Delegate to the Permanent Committee of the International Institute.

LUXEMBURG :

T. VERNIEUWE, Director of the Horticultural Office, Ministry of Agriculture, Brussels.

O. BOLLE, Delegate to the Permanent Committee of the International Institute.

P. MARCHAL, Agricultural Institute, Gembloux.

MONACO :

Dr. PAUL REGNARD, Member of the Academy of Medicine, Director of the " Institut Agronomique " and of the Oceanographical Institute, Paris.

MAROCCO :

LOUIS-DOP, Vice-President of the International Institute.

NETHERLANDS :

Baron W. B. R. DE WELDEREN RENGERS, Minister Plenipotentiary, Delegate to the Permanent Committee of the International Institute.

P. van HOEK, Director of Agriculture.

Prof. T. RITZEMA BOS, Director of the Phytopathological Institute, Wageningen.

OTTOMAN EMPIRE :

Dr. MEHMED DJEMIL BEY, Delegate to the Permanent Committee of the International Institute.

ROUMANIA :

C. PENNESCO, Councillor at the Legation, Delegate to the Permanent Committee of the International Institute.

V. BARANGA, Secretary of the Ministry of Agriculture and Estates.

G. ARION, Entomologist, Ministry of Agriculture and Estates.

RUSSIA :

His Excell. G. ZABIELLO, Consul General, Delegate to the Permanent Committee of the International Institute.

A. DE JACZEWSKI, Lord Chamberlain to H. M.the Emperor, Director of the Mycological and Phytopathological Bureau of the Scientific Committee of the Office for Agricultural Organisation and Agriculture.

SERVIA :

L. MICHAÏLOVITCH, Chargé d'Affaires.

SPAIN :

E. R. DE CELIS, Delegate to the Permanent Committee of the International Institute.

SWEDEN :

Baron C. N. D. DE BILDT, Minister Plenipotentiary, Delegate to the International Institute of Agriculture.

Prof. J. ERIKSSON, Chief of the Botanical Section, Central Institute for Agricultural Experiments, Stockholm.

SWITZERLAND :

J. B. PIODA, Minister Plenipotentiary, Delegate to the Permanent Committee of the International Institute.

Prof. MÜLLER-THURGAU, Director of the Federal Experimental Station for Arboriculture, Viticulture and Horticulture, Wadensweil.

Dr. FAES, Director of the Phytopathological Section of the Viticultural Experimental Station, Lausanne.

TUNIS :

LOUIS-DOP, Vice-President of the International Institute.

A series of meetings was held from February 24 to March 4, 1914, at which the delegates expressed the general desire of their respective Governments to abide by previous decisions of the General Assemblies of the International Institute of Agriculture, and to continue and further measures already agreed upon at previous agricultural congresses. The Conference, without in any way interfering with the measures adopted under existing international agreements, drew up the following draft Convention to be dated March 4, 1914, and to be submitted to the various Governments for approbation, and signed by plenipotentiaries nominated for the purpose if approved.

Art. 1. — The contracting States undertake to adopt the legislative and administrative measures necessary to ensure common and effective action against the introduction and spread of plant enemies.

These measures shall especially deal with : 1) the efficient supervision of nurseries, gardens, green-houses, and other establishments supplying the market with live plants (young plants, cuttings, scions, flower-bulbs and cut blossoms) ; 2) the reporting of the appearance of plant diseases and of injurious animals, and the specification of infected districts ; 3) the means of checking and preventing plant diseases ; 4) the regulation of the transport and the packing of plants and of the parts of plants mentioned above ; 5) the measures to be taken in case of infringement of regulations.

Art. 2. — There shall be created in each State adhering to the present

Convention an official Phytopathological Service for the purpose of carrying out these measures.

The official Phytopathological Service will include as a minimum: 1) the creation of one or more research stations for scientific and technical investigations; 2) the organisation of the efficient supervision of cultivation; 3) the inspection of consignments; 4) the issue of phytopathological certificates.

Art. 3 — The measures mentioned in paragraphs 2, 3 and 4 of art. 2 shall already have been carried out at the time of the ratification of the present convention, or of adherence to it. All the other measures in arts. 1 and 2 shall be carried out in each State within two years from the date of the ratification of the present Convention, or of adherence to it.

Art. 4. — The provisions of the present Convention shall not apply to vines, grain and seeds, edible tubers, bulbs, rhizomes and roots, fruits and vegetables, or to any crops grown on a large scale.

Art. 5 — With a view to the protection of the contracting States from the introduction and spread of plant enemies, these States undertake to allow the importation of live plants (young plants, cuttings, scions, flower-bulbs and cut flowers) only if they are accompanied by a phytopathological certificate issued by competent officials of the exporting country.

Art. 6. — The importation of the plants mentioned in the preceding article shall take place only through specified customs offices, of which a list will be drawn up by the importing country and sent to the exporting country.

Art. 7. — Each country reserves the right of inspecting all living plants, or parts of plants, imported.

In the event of the consigment being infected, contrary to the declaration on the certificate, the importing country shall at once inform the Government of the exporting country, which will take the measures provided for by its own regulations.

Products recognized as infected shall be returned to their original starting point at the expense of the defaulting party, or burnt should the consignee desire it; in the latter case, an official report shall be forwarded to the Government of the exporting country.

Art. 8. — The certificates shall conform to the model annexed to this Convention, and shall be drawn up in two languages: French, and the language of the exporting country.

Art. 9 — Live plants imported for scientific purposes are not subject to these restrictions; they may be admitted, even without certificate, on condition that they are directed to a scientific institution duly authorised by the Government of the importing country, and that the conditions under which they are sent afford every guarantee against the dispersion of the parasites. Contiguous States may make mutual arrangements to facilitate exchanges of plants in the frontier zones.

Art. 10. — The different contracting States are invited to send a list of the plant enemies against which they desire to protect themselves, to the

International Institute of Agriculture at Rome, at the time of the ratification of the present Convention or of their adherence to it. The list will be as short as possible and will be entered on their respective certificates. These lists will be drawn up according to the following principles:

A. Common enemies of plants, which have long since spread to nearly all countries, will be excluded from the lists; as well as parasites whose usual host-plants do not exist in the importing countries.

B. In specifying the plant enemies which are to appear on the lists, the choice will be limited to:

1. Those of an epidemic character.
2. Parasites which are destructive, or at least very harmful to crops.
3. Those which are easily propagated by live plants, or by living parts of plants.

Art. 11. — The creation of an official Service of Phytopathology shall be notified by each contracting State to the International Institute of Agriculture at Rome.

Art. 12. — From the date of the signature of the present Convention, the contracting States shall recognise the International Institute of Agriculture at Rome as the official international centre for all questions relating to plant enemies.

The Institute shall collect statistical data, together with information of an administrative, scientific, or practical nature dealing with all plant diseases and plant enemies. These data will be obtained from documents which shall be furnished to it as promptly as possible by the official Phytopathological departments, and by the Phytopathological Research Stations authorised and controlled by the Governments.

Art. 13. — The International Institute of Agriculture shall publish, at least once a month, the administrative, scientific and practical information transmitted to it.

Art. 14. — Every proposal made by a contracting State, for the modification or amplification of the present Convention, shall be communicated by that State to the Institute, and referred by it to a meeting of special delegates of the contracting parties, which shall be called together on the occasion of a General Assembly of the Institute.

The General Assembly will subsequently submit the proposals elaborated by these special delegates for approbation by the States adhering to the present Convention.

Art. 15. — In case of any disagreement between two, or more, of the contracting States as to the interpretation of the clauses of this Convention, or in cases of difficulties of a practical nature with regard to its application, the parties in question undertake to submit their differences to discussion by a special mixed Committee formed by members of their Phythopathological departments, with a view to the proposal of measures calculated to adjust the differences.

Art. 16. — The States bound by the present Convention shall not treat non-contracting Countries more favourably than contracting States.

Art. 17. — The present Convention shall be signed and ratified as soon as possible, and the ratifications shall be deposited with the Italian Government as soon as at least three of the contracting States are in a position to do so.

Each ratification shall be communicated by the Italian Government to the other contracting States, and also to the International Institute of Agriculture.

Art. 18. — States which have not signed the present engagement shall be allowed to adhere to it on request.

At the request of the States upon which they are dependent, Colonies shall be permitted to adhere on the same conditions as independent States.

Art. 19. — Adherence shall be notified through diplomatic channels to the Italian Government, and by it to the contracting Governments and also to the International Institute of Agriculture.

Art. 20. — The ratification, or adherence, shall be accompanied by a formal declaration to the effect that the State possesses at least the staff mentioned in paragraphs 2, 3 and 4 of art. 2.

The present Convention will come into force, for the three first States at least which shall have ratified it, after a lapse of three months from the date of ratification ; for the other States, after a lapse of six months from the respective date of deposition with the Italian Government of their ratification, or adherence.

Art. 21. — Should it happen that one of the contracting States wished to withdraw from the present Convention either with regard to its whole territory, or only with regard to the whole or a portion of its Colonies, its wirthdrawal shall be notified to the Italian Government, which shall immediately send a copy of the notification to all the other States, informing them of the date on which it received the communication.

The withdrawal will apply only to the notifying State or to the Colonies mentioned in the notification, and this only after one year has elapsed from the time the notification was received by the Italian Government.

As a guarantee, the delegates attending the final meeting signed the formal record of these recommendations, which was dated Rome, 4th March, 1914. The original document is deposited at the Italian Ministry for Foreign Affairs. Certified copies will be sent to all the States represented at the Conference.

APPENDIX TO THE FINAL ENACTMENT OF THE CONFERENCE.

International Phylloxera Convention of Berne
and International Phytopathological Convention of Rome

CERTIFICATE
FOR THE DESPATCH OF HORTICULTURAL PLANTS. *

NAME OF COUNTRY OF EXPORT

I. — Declaration of Consigner.

The under-signed (1) . . . . . hereby declares :

A. That the plants (2) . . . . . contained in (3) . . . . . .packages, marked . . . . (4) . . . . .addressed to (5) . . . . . in (6) . . . . . .have been produced on his establishment, or on other establishments subjected to inspection by the Phytopathological department.

B. That this consignment contains no vines.

C. That the plants are packed (7) . . . . . .their ball of soil.

(8) . . . . . the . . . . .day of 191

Establishments inscribed on the list drawn up according to art. 9 § 6 of the Phylloxera Convention of Berne, under the No. . . . . (10)

Consigned by . . . . . (9)

(1) Name, firm, profession and address. — (2) Kind and quantity of plants. — (3) Number of packages. — (4) Mark and number. — (5) Full address, name and profession of consignee. — (6) Name of country of destination. — (7) State whether the plants are packed *with* or *without* their ball of soil. — (8) Place from which sent. — (9) Signature of consigner. — (10) Give the number entered on general list.

* Each statement on the certificate must be accompanied by a translation in French.

II. — Certificate of the Administrative Authority *.

The administrative authority (1) certifies :

A. That the above consignment of plants comes from a holding that is at least 20 metres distant from any vine stock, or that is separated from such stock by an obstacle to roots which is considered to be sufficient by the competent authority.

B. That the holding itself contains no vines.

C. That no depôt for this plant exists on the holding.

D. That the holding has never been a centre of phylloxera infection.

E. That if the holding has contained phylloxerous vines at any time, these have been radically removed, and that suitable means of eradicating the disease and repeated inspections for three consecutive years, have ensured the complete destruction of the insect and of the roots.

Date . . . . . .

Seal of competent local authority

. . . . . .

(signature)

(1) Burgomeister, mayor, or other competent local authority.

* This certificate should not be filled in where the holding figures on the list published in accordance with art. 9 § 6 of the International Phylloxera Convention of Berne.

III. — Certificate of Phytopathological Inspection.

The undersigned Inspector of the Phytopathological Department (1) . . . . . certifies that the consignment referred to in the declaration of the consigner (2) . . . . . .consists of the produce of crops grown at . . . . . .

The results of inspection have shown that the

(3) { home-grown produce / transported produce }

is in a satisfactory state of health and is free from the following parasites (4) . . . . . .

. . . . . .

Date . . . . . .

Seal

(Signature)

(1) Christian name, surname, official position and address of the inspector. — (2) Christian name and surname of the consigner. — (3) Strike out, as required, the irrelevant words.. — (4) Add the list of plant parasites enumerated in the official list of the importing country which might be present in the consignment.

385 – **A Law Placing at the Disposal of the Minister of Agriculture of France from the Budget of 1913 the Sum of 750 000 frs. for the Control of Voles.** — *Journal Officiel de la République Française*, Year 46, No. 10, p. 314. Paris, January 11, 1914.

On January 7, 1914, the President of the Republic French promulgated the following law.

The sole article. — In addition to the sums allotted to the Minister of Agriculture from the Budget of 1913 by the finance law of July 30, 1913, and by special laws, an extraordinary credit of 750 000 fr. (nearly £ 30 000) is placed at his disposal ; this sum will be entered under a special heading bearing the number 28 *bis* and entitled as follows: " Grants to Communes, Syndicates and Agricultural Associations for the Destruction of Voles. Cost of Organisation of Control Measures ".

This sum will be provided by the general funds of the financial year 1913.

DISEASES NOT DUE TO PARASITES AND OF UNKNOWN ORIGIN.

386 – **The Importance to Vegetation of the Dissipator (Lattice-work) Chimney.** — WINKELMANN, H. in *Die Naturwissenschaften*, Year II, Part 10, pp. 225-229 + 2 plates. Berlin, March 6, 1911.

The writer describes a new method of preventing the bad effect upon vegetation which is exerted by the smoke gases from factories. This method consists in the adoption of the so-called lattice-work or dissipator chimney. The latter differs from an ordinary chimney in the fact that the smoke leaves the shaft already mixed with air and with a more or less strong rotatory motion, and not in a compact column ; this permits of the more rapid division of the smoke and of its quicker diffusion in the atmosphere. No chemical change takes place, however, in the injurious gases which are given off.

BACTERIAL AND FUNGOID DISEASES.

387 – **Fungus Diseases of Wheat, Barley and Citrus Fruits in Egypt.** — ROLLAND, B. G. C. in *The Agricultural Journal of Egypt*, Vol. III, Part I, pp. 28-30, plate I. Cairo, 1913.

The smut diseases, known in Arabic as " el khamira ", are of frequent occurrence throughout Egypt. Wheat is attacked chiefly by *Ustilago Tritici*, while barley is attacked by both *U. nuda* and *U. Hordei*.

The writer also describes a disease of citrus fruits, especially oranges, known as wither-tip and caused by *Colletotritichum gloeosporioides* Penz.

He gives an account of the means by which these fungi are controlled.

388 – **Experiments on the Control of *Pleospora trichostoma* on Barley.** — Müller, H. C. and Molz, E. in *Deutsche Landwirtschaftliche Presse*, Year XXXXI, No. 17, pp. 205 and 206. Berlin, February 1914.

As the control of the " brown streak " of barley leaves (caused by *Pleospora trichostoma* = *Helminthosporium gramineum*) is generally combined with the control of the two smuts (*Ustilago Hordei* and *U. nuda*), the writers carried out experiments in this direction. They obtained the following results :

1) Winter barley was entirely freed from *Pleospora trichostoma* by 16 hours' treatment with Kühn's ½ per cent. copper sulphate. The germination of the seed in the field was, however, diminished from 95.2 to 80.2 per cent.

2) The hot-water treatment was harmful to both winter and summer barley. On the other hand, intermittent hot water treatment was efficacious in the control of *Pleospora trichostoma* ; this was of greater practical importance from the fact that both the smuts were destroyed at the same time, although the fact that the smut attack was not severe makes it impossible to give a safe opinion as to the efficacy of the remedy in the latter case. The treatment consists in putting a sack three-quarters full of barley for 3 hours into water at 40° C. (104° F.) and then for 10 minutes into water at 48° C. (118.4° F.) After the grain has been somewhat cooled by being put for one minute into water at about 40° C., it is left in the sack for two hours in a heated room and subsequently again immersed for 10 minutes in water at 48° C. Then it is spread out and quickly dried by repeated shovelling. As this process has an injurious effect on germination, 10 per cent. more seed should be sown than usual.

3) A combination of the hot-water and copper sulphate treatments destroys *Pleospora trichostoma* on winter barley, but is liable to do much injury to the germinating property of the grain.

4) Formaldehyde, which has been largely and successfully used in the control of bunt of wheat, had little effect on *Pleospora trichostoma* on summer barley.

5) Hot-air treatment in a thermostat considerably increased the severity of the attack of *Pleospora trichostoma*.

The observations made for the purpose of ascertaining how for the attack depended upon the time at which the barley was sown, showed that the temperature during the germination and growth of the young barley plants greatly influences the occurrence of the disease. Other reasons, however, make it undesirable to try and control the parasite by means of later sowing.

389 – **Experiments on the Control of *Urocystis occulta* (Wallr.) Rabenh. on Rye.** — Müller, H. C., and Molz, E. in *Deutsche Landwirtschaftliche Presse*, Year XLI, No. 13, p. 164 + 2 plates. Berlin, February 14, 1914.

The results of the pickling experiments carried out by the writer for the control of " stem-smut " of rye (*Urocystis occulta*) are given in the following table.

Number of plot	Treatment	Germination in artificial germinating bed after 5 days %	Germination in artificial germinating bed after 10 days %	Germination in the field %	*Urocystis occulta*: No. per plot
1	Untreated.	82.5	86.0	73.2	234
2	Copper sulphate ½ %, 16 hours	82.0	86.5	73.4	0
3	» » » » 16 hours + subsequent 6 % lime treatment	79.0	82.0	77.6	0
4	Copper sulphate 3%, incrusted	79.0	84.0	78.8	0
5	Linseed oil soft soap 3 %, incrusted; then copper sulphate 3 %, incrusted	87.0	88.5	77.6	3
6	Copper sulphate 5 %, incrusted	69.0	84.5	64.6	0
7	Linseed oil soft soap 3 %, then copper sulphate 5 %, incrusted	76.1	87.5	72.6	0
8	Bordeaux mixture 2 %, incrusted.	81.5	85.5	72.0	0
9	Linseed oil soft soap 3 %, then Bordeaux mixture 2 %, incrusted	86.5	89.5	75.0	7
10	Formaldehyde * ¼ %, 15 minutes	83.0	89.5	81.6	0
11	» » 30 »	79.5	87.0	72.0	0
12	Untreated	82.5	86.0	74.6	226
13	Formaldehyde ½ %, 15 minutes..	84.5	87.0	62.2	3
14	» » 30 »	74.0	84.0	63.8	0
15	» ¾ % 15 »	64.0	79.0	46.6	1
16	» » 30 »	34.0	78.5	42.2	0
	Soaking in: water at / and hot water at				
17	30° C., 4 hours / 50° C., 10 minutes . .	51.0	85.5	67.0	2
18	» » / 52° C., 5 » . .	63.5	84.5	78.4	0
19	» 6 hours / » 10 » . .	63.5	87.0	70.2	0
20	20° C., 15 » / 50° C., 10 » . .	42.5	79.0	74.0	0
21	» » » / 52° C., 5 » . .	6.5	41.5	34.4	3
22	» » » / » 10 » . .	0.0	26.0	9.8	0
23	Jensen method.	82,0	85.0	78.8	3
24	Untreated , ...	85.0	87.0	78.8	154
25	Sublimate 0.1 %, incrusted	87.0	90.0	77.4	3

* Using 40 % commercial formaldehyde.

From these figures, it is clearly seen that *Urocystis occulta* is very easily controlled by the well-known dip poisons, copper sulphate and formaldehyde, and also by the hot water treatment.

PARASITIC AND OTHER INJURIOUS FLOWERING PLANTS.

390 – ***Ranunculus sceleratus*** (1) **and *R. Guilelmi-Jordani* as Weeds in Egypt.** — ROLLAND, B. G. C. in *The Agricultural Journal of Egypt*, Vol. III, Part I, pp. 31-32, plates II-III. Cairo, 1913.

These two species of *Ranunculus* are considered noxious weeds in Egypt. *R. sceleratus* L. is a common plant by the sides of pools and wet ditches, and is particularly common on the fresh Nile mud on both sides of the river. It flowers from April to January. *R. Guilelmi-Jordani* Aschers also grows by the side of pools and wet ditches and flowers during the same period.

INSECT PESTS.

GENERALITIES.

391 – **Entomological Pests and Problems of Southern Nigeria.** — PEACOCK, A. D. in *Bulletin of Entomological Research*, Vol. IV, Part 3, pp. 191-220, plates XXIII-XXVIII. London, 1913.

The writer gives an account of the results of a journey made in Southern Nigeria with the object of studying the economic conditions of the colony in connection with the insect pests of cultivated plants.

INSECTS AFFECTING COTTON.

Cotton stainers. — Among the insects that injure cotton the most interesting is the red cotton-stainer bug (*Dysdercus superstitiosus* F.). This stainer is the worst pest of Southern Nigerian cotton, and does an immense amount of harm both to the seed and to the lint, by sucking the juices of the former and staining the latter with yellow excretory juices. The stained condition of the cotton in the native markets in the Western Province, and especially the cotton gathered late in the season, is striking.

The writer made some experiments to test the value of cotton seed and pressed cotton seed as bait for the purpose of enticing stainers, and then catching them directly with traps or shaking the plants over a funnel-shaped collecting net. The best system hitherto adopted by the Superintendent of Agriculture, Ibadan, consists in gathering the cotton as soon as it is ripe, sunning it well and constantly turning it over, which causes the stainers to crawl away, when they may be collected and killed, thus diminishing the chances of further staining, and lastly burning the old cotton stalks.

The black cotton-stainer (*Oxycarenus dudgeoni* Dist.) is probably distributed throughout the whole Colony ; it also is very injurious to cotton, because like the preceding s ainer it sucks the juices of the seeds ; it lays its eggs in clusters at the base of the boll, securely protected by the lint from sun and possible enemies. There seems to be a decided preference for

(1) See also No. 187, *B.* Feb. 1914. (*Ed.*).

certain species of *Hibiscus* as food plants, for some of these plants were found at Ibadan to be black with these pests.

The measures suggested to control the red cotton bug apply equally well here.

Boll-worms. — The larvae of *Diparopsis castanea* Hmp., *Earias biplaga* Wlk., and *Chlorida obsoleta* F. bore into the unopened ripening cotton and devour the seeds inside. The larvae leave one boll for another and frequently all the bolls on one plant are utterly spoilt. At the end of the 1911 season the condition of the plants was found to be serious.

The treatment may be outlined as follows: For imported cottons, a careful look-out should be kept for leaf-rollers and boll-worms during August and September. Immediately the presence of the insects is detected, the leaves, bracts, bolls and buds in the affected area should be most thoroughly sprayed, more or less frequently according to the condition of the crops as the season advances. At the end of the season all the old stalks with the diseased bolls should be burnt.

As for native cottons, before they can be treated as suggested above, two courses are open: 1) the obtaining by selection of a smaller native variety; 2) the topping and trimming of the plants and widening the distance between the drills.

Leaf-rolling caterpillars. — The larvae of *Sylepta derogata* F. and *Zebronia phenice* Cram. cut and roll the leaves of cotton into the shape of a tent; in these shelters they feed on the inner rolls of the leaf. As many as 12 caterpillars of *Sylepta derogata* may flourish in one shelter, while *Zebronia phenice* is usually solitary and is generally found where okra (*Hibiscus esculentus*) is grown. *S. derogata* is extensively parasitized by a species of Braconid and a Tachinid fly.

The *green fly* (*Aphis gossypii* Glov.) — Its numbers are kept well in check by natural enemies. Should the aphis show the least sign of increasing beyond natural control, spraying with a resin wash is recommended.

The following insects have also been observed as injurious to cotton plants: *Epilachna chrysomelina* F., *E. similis* Muls. var. *assimilis* Muls., *Lagria villosa* F., and *L. viridipennis F.*, *Siderodactylus* sp., *Syagrus calcaratus* F., *Plagiodera circumcincta* Sahlb., *Nisostra uniforma* Jac., *Ootheca mutabilis* Sahlb., *Euproctis* sp. and *E. lyonia* Swinh., *Pulvinaria jacksoni* Newst., *Ripersia* sp.

Some of the above insects are parasitized by Hymenoptera and Diptera not yet determined.

The writer mentions a curious affection observed on the native Ishan and Meko cottons. The leaves become at first mottled with pale green or yellow spots, the undersides being densely and minutely pock-marked. Ultimately the leaves shrivel and curl. The young leaves at the tip of the shoot seem to be affected first, the older and larger leaves afterwards, till the whole plant presents a most forlorn appearance. The cause of the disease is probably physical, as no insect or mite was discovered. From the end of August to the end of October 1912 the trouble grew roughly from 8 per cent. to 25 per cent. The percentage was arrived at by ob-

serving the same plants to the number of 1000 in the Ishan, and 1800 in the Meko.

Cotton demands unceasing watchfulness and care from the time when it has two leaves, when attacks of grasshoppers, beetles and caterpillars may be detrimental to a good early strart; through the leaf growing period when leaf-rollers, caterpillars and aphis are at work; through the all-impoıtant period of bud - and boll-formation, when boll-worms are active; and up to the ripening and picking period, when stainers are mischievous. The measures recommended will not be of any use unless the pests are attacked with energy and general cooperation. The difficulties of making cotton worth extensive exploitation are many: these are the inertia of the native towards clean farming; the difficulty of obtaining a good variety of native cotton which would fetch better prices and make it worth while expending labour and money in combating pests; the difficulty of popularising even simple entomological methods; and greatest of all the fact that cacao and rubber are more valuable than cotton and that the country is the land *par excellence* of the oil palm.

Even if a better native variety is produced, cotton will probably never be more than a useful native catch-crop.

Insects affecting cacao.

Cacao is attacked by leaf-eating caterpillars, among which is *Diacrisia maculosa* Stoll., a species widely distributed throughout Africa; the caterpillars are voracious feeders, like those of *Prodenia litura* F. which devour the leaves. From a larva of this species an Ichneumonid, *Metopius discolor*, has been bred. Another species of *Diacrisia* and *Rhopalocampta forestosa* Cram. also feed on the leaves. The writer enumerates many other insects found on cacao, but little is known as to their economic signifiance.

The leaf-eating beetle, *Adoretus hirtellus* Castn., common in West Africa, feeds on the leaves of cacao, eating only the soft tissue. After describing some experiments made to control this pest, the writer advises clean farming and the segregation of cacao beds from maize, a combination of hand-collecting and spraying and maintaining unremitting watchfulness.

Another serious pest is the pod-borer, perhaps belonging to the genus *Myelois*, which is found in large numbers, up to 120, meshed in a ravel of silk among dry brown powder and riddled seeds, in cacao pods left hanging on the trees or lying on the ground. Judging from the thousands of old pods thus left neglected at Agege on the native farms, the damage done must be incalculable. The larva of a Cerambycid, common at Agege, does serious damage by boring in the trunk and branches; the adult is unknown.

Catantops vittipes Lauss. (Locustidae) eats the leaves. *Ceratitis punctata* Wied., a species of *Monanthia*, *Pseudococcus virgatus* var. *madagascariensis* Newst. and *P. citri* Risso (?) are also injurious.

The red tree-ants (*Oecophylla smaragdnia longinoda* Latr.) are not harmful to the cacao trees, but owing to their numbers and their irritating bite, they are a great nuisance to the native collector when at work.

Among the beneficial insects the writer mentions *Metopius discolor* Tosq., a *Sisyropa* which parasitizes the larvae of *Diacrisia maculosa* Stoll., and the following Carabidae which are probably useful in destroying harmful insects : *Oodes obesus* Murray, *Platynus planaticollis* Murray and *Chlaenius westermanni* Laf., and some others of doubtful significance.

Insects Affecting Maize.

Among the insects injuring maize, *Cirphis ? phaea* Hmp. (« rami-rami ») occurs in several localities in the Colony. Its larvae appear in swarms and do not leave a trace of grass or maize behind them. The maize replanted after the visitation of the caterpillars does not stand a good chance of succeeding, because of weather conditions. The control of this pest demands vigilance ; as soon as the young caterpillars are detected, burning the grass or bush round the fields and lawns will destroy large numbers of them. Caterpillars which appear on the maize can only be prevented from doing extensive damage by spraying. Other injurious insects are *Calamistes praepallens* Hmp. and *C. fusca* Hmp., the caterpillars of which bore into the maize stems and frequent the flowers also, and Noctuid caterpillars of a species not yet determined ; the latter bore into the seeds and destroy them, causing much injury ; on account of their numbers, size and voracity they are undoubtedly the worst maize pest. The beetles *Lagria villosa* F. and *L. viridipennis* F., and the locust *Zonocerus variegatus* L., are general leaf-eaters which also frequently damage maize.

In order to free stored grain from *Calandra oryzae* L., *Tribolium castaneum* L., *Laemophloeus pusillus* Schön. and *Silvanus surinamensis* L., the natives use very primitive and imperfect methods of disinfection (heat and smoke), and it is very difficult to popularise modern efficient methods of fumigation.

Insects affecting Yams. — The following are mentioned by the writer : *Prionoryctes caniculus*, Arrow., *Crioceris livida* Dalm., *Apomecyna parumpunctata* Chev., *Lagria villosa* F., *L. viridipennis* F. and *Zonocerus variegatus*.

Insects affecting Funtumia Rubber. — *Glyphodes ocellata* Hmp., *Nephele aequivalens* Walk., *Thermopteryx elasticella* Hmp. and *Physothrips funtumiae* Bagn.

Insects affecting Para Rubber. — Larvae and insects have been found boring into these plants.

Insects affecting Mahogany. — Mahogany trees (*Khaya senegalensis*) at Calabar have suffered severely from the attacks of wood-boring lepidopterous larvae, probably Cossidae, which bore holes into the trunk and branches. Another lepidopterous larva and a nocturnal cricket, possibly *Brachytrypes*, injure these trees.

Insects affecting Arabian Coffee. — The following insects were found upon coffee : *Ootheca mutabilis* Sahlb., *Antestia variegata* Thumb., *Riptortus tenuicornis* Dall. and *Dictyopharina serena* Stål.

Insects affecting other plants. — *Rhynchophorus phoenicis* F., on the oil palm ; *Tennoschoita quadrimaculata* Gyl. and *Archon centaurus* Burm. on coconut palm ; *Adoretus hirtellus* Castn. on kola ; *Cosmophila erosa, Zebronia phenice, Dysdercus superstitiosus* and *Oxycarenus dudgeoni* on Okra (*Hibiscus esculentus*) ; *Lagria villosa* F., *L. viridipennis* F., *Monolepta* sp., *Zonocerus variegatus* F., *Azazia irrorata* F. have been observed upon the cowpea, and *Apate terrebrans* Pall. upon *Poinciana regia.*

MEANS OF PREVENTION AND CONTROL.

392 – **Arsenite of Zinc as an Insecticide.** — SCHOENE, W. G. in *New York Agricultural Experiment Station, Technical Bulletin*, No. 28, pp. 1-16. Geneva, N. Y., 1913.

The writer gives the results of a series of experiments on the determination of the toxicity to insects of zinc arsenite and lead arsenate, and the resistance of leaves to zinc arsenite. In this respect 1 lb. of arsenite of zinc is equivalent to 3 lbs. of arsenate of lead. The addition of slaked lime or Bordeaux mixture to the zinc arsenite prevents any damage to apple foliage, but when it is used alone, or with lime-sulphur wash or glucose, it causes more or less spotting of the leaves. Arsenite of zinc, either alone or mixed with glucose, causes severe scorching of the leaves of the vine. Laboratory experiments show that the damage caused by arsenite of zinc is partly due to its solubility in carbonic acid. The contradictory results obtained with this insecticide are presumably due to the lack of uniformity in its manufacture. Arsenite of zinc and arsenate of lead mixed with either Bordeaux mixture, soap or glue retain their activity for 25 days. Applied alone or with glucose they gradually lose their poisonous properties on exposure to the weather, and at the end of 25 days cease to protect the foliage. Lime-sulphur wash does not appear to resist moisture as well as Bordeaux mixture.

393 – **Destruction of Locusts in Turkestan.** — *Communicated by* JOS. P. BARSACQ, *Commissioner in Russia for the French Ministry of Agriculture.*

From the earliest times, locusts have always been the most serious pests of agriculture in Central Asia ; formerly the inhabitants, for religious reasons, did hardly anything to check their periodic invasions, but since the conquest of Turkestan the Russians have paid considerable attention to them, though it is only within the last few years that a methodical campaign against these dangerous enemies has been organized. If one considers that Turkestan furnishes Russia with almost half the cotton used in her mills (or about 120 000 tons), and that cotton suffered most from the repeated attacks of locusts, it will be readily understood that the Russian Government has every interest in ensuring the free development of this important crop. Further, Turkestan is still almost without rapid means of communication, and consequently has to depend on its own production of cereals, so that the protection of the cultivated land from the more or less frequent attacks of locusts had become urgent.

The fauna of Turkestan includes a number of species of locusts, but they are not all equally harmful. The first place is certainly taken by the Marocco locust (*Stauronotus maroccanus*), which prefers uncultivated arid plains for its egg-laying. The permanent area of distribution of this species comprises the steppes of Samarkhand, the Khanat of Bokhara, and Afghistan; it is not rare to find important egg-laying centres in various parts of Turkestan, but they cannot be considered as anything but temporary. The Marocco locust lays eggs up to nearly 2000 m. (6600 ft.) above sea-level; sometimes the density of eggs reaches 10 000 clusters per square yard; each egg-laying centre usually occupies some hundreds of acres, but may run into thousands. In normal seasons hatching takes place between the 2nd and 10th of April, lasting 7 to 10 days. The date and duration of hatching are, however, much influenced by the altitude, the position of the centres, the temperature and nature of the soil, and the rainfall. The larval period lasts from 35 to 50 days, during which time the voracity of the insect constantly increases. An idea of the enormous damaged caused by this species to the crops in Turkestan may be had from the table given below.

The migratory locust (*Pachytylus migratorius*) possesses several permanent areas of distribution in Central Asia, including the reed-beds along the banks and in the deltas of the rivers Sir-Darya, Amu-Darya, Zarivachan, Ili and Tchou. This species rarely damages crops, preferring the shoots of the reeds which occur in abundance near the egg-laying areas. At the same time official data for 1896 speak of 75 000 acres of various crops dammaged by this species, possibly assisted by the nearly related *P. danicus*; in recent years it has confined itself to uncultivated places, and no serious complaints as to damage done by it have been received.

The Italian locust (*Caloptenus italicus*) is a common species in Turkestan, but till recently only caused insignificant damage. This appears to have been due to considerable destruction by natural enemies. Recent observations also show that it is almost always starved out by the more voracious Marocco locust; an interesting fact is that in regions in which the Marocco locusts were completely exterminated two or three years ago, *Caloptenus* is now increasing to an alarming extent, and occurs in numbers unknown before the disappearance of *Stauronotus*.

The following locusts are also known as injurious in Turkestan, though not to the same extent as other species: *Oedalus nigrofasciatus* Deg., *Stetophyma* (*Arcyptera* Serv.) *flavicosta* Fisch., *Arcyptera* (*Pallasiella* Kirby) *truchmanna* Fisch-Waldh., *Acridium* (*Orthacanthracis* Karsch) *aegypticum* L., *Stauronotus kraussi*, *S. tartarus*, *S. anatolicus* and *S. brevicollis*.

Destruction of locusts.

All the known means of destruction of locusts have been tried in Turkestan; the following is a brief summary of the work.

A) Mechanical means:

1) Collecting and destroying the egg-clusters was carried out on a large scale for several years, but with next to no results, for the locusts

appeared in quantities at all the egg-laying centres and did enormous damage (amounting to nearly half a million sterling, according to the official figures). This laborious and irrational method has been definitely abandoned.

2) Destruction of eggs by ploughing under has given no decisive results.

3) Flooding of the eggs is a radical remedy, but unfortunately is only applicable on continuous areas with a plentiful water supply.

4) Crushing the larvae by wooden or iron rollers made extra heavy by loads of earth stones, etc., and sometimes with thorny twigs drawn behind, has been practised with success in some parts of Turkestan. It seems, however, to be a rather cumbersome method.

5) Collecting the larvae in sheets has hardly been practised on a large scale except in the Ferghana region: it has been given up as not convenient.

6) Catching the larvae in pits or ditches dug near the swarms or in the way of moving columns of larvae has long been carried out in all parts of the country ; pits are only used in the case of large swarms on a limited area. The destruction of columns of large locusts has also been attempted by the use of barriers similar to those used in Cyprus and Durand's apparatus; the canvas was replaced by rolls of old sheet-iron 12 to 14 inches high, held up by short stakes. This is very effective, but is costly to put up. Ditches are excavated in the line of march of travelling columns of locusts and are dug 2 to 3 ft. deep and the same in width, generally with vertical sides ; at intervals along the bottom holes are dug out 14 to 20 inches deeper, for the larvae to collect in. Circular trenches may also be dug round very dense egg areas before the larvae hatch out, but these are very expensive and are not infrequently made useless by the destruction of the egg-clusters by insects or fungi.

7) " Fishing " of locusts in streams and irrigation canals is practised when other means for stopping the moving columns have failed. But as suitable watercourses rarely occur in the track of the columns, this method is of limited value, especially as the destruction is by no means perfect.

8) Destroying the larvae by fire is carried out on a large scale in Turkestan. The method at present used is scorching by means of a special knapsack apparatus ; the petroleum flare of this can be turned on to the larvae in various directions with very little loss of heat. Several systems were tried (Siédoff, Schkilin Bildin, etc)., and the Schkilin apparatus was found to give the best flame. This method, however, comes rather expensive, and is only justifiable on irregular land free from grass and without streams or other supply of water. Large machines on the same principle have also been tried, but they have not given good results in practice.

B. CHEMICAL MEANS. — a) *Internal poisons.*

1) Spraying for locusts with Paris green has been tried on a large scale and has given excellent results. The best strengths have been found to be: up to the 3rd moult of the larvae, 4lbs. Paris green and 8lbs. lime in

100 gallons of water ; later 5 ¼ lbs. Paris green and 10 ½ lbs. lime to 100 gall. ; and when the larvae are threatening the cultivated land the strength is increased to 8 lbs. Paris green with 10 ½ lbs. lime. About 24 gallons of spray are required to treat an acre. The total expense (apparatus, insecticide, labour, etc.) comes to about £ 3 3*s* 6*d* for a day's work, in which about 27 ½ acres would be treated, making about 2*s* 4*d* per acre. In spite of the cheapness of Paris green spraying, it has several drawbacks : the spray is easily washed off by rain or dew, so that spraying may have to be repeated; it can only be used where the ground is covered by vegetation ; the lime for making the mixture may not be obtainable near at hand, and does not keep well ; the Paris green does not affect the larvae till about the third day, so that the effect cannot be ascertained at once, and washing off by rain may not be noticed. The following table shows the area treated with Paris green (at the expense of the State) during the last few years, and the number of large machines used :

Year *	1902	1903	1904	1905	1907	1909	1910	1911
Area treated **, acres	121 259	137 084	147 023	93 335	11 342	8 308	124 442	196 710
Paris green used, lbs.	148 390	191 410	198 640	106 710	19 254	13 885	195 860	286 840
No. of large machines working .	110	136	136	141	48	30	238	404

* No treatment in 1906 and 1908. — ** Treatment lasts 21 to 26 days per year.

To prevent the mixture being washed off by rain, an attempt has been made to use molasses instead of lime ; this has the further advantage of being attractive to the locusts. The molasses is used in double the amount for lime, the Paris green remaining the same ; when molasses can be obtained cheaply, this mixture should be preferred, as it gives excellent results.

2) Ammonium arsenite, obtained by treating Paris green with ammonia, has been tried in Turkestan at the suggestion of Schreiner (1911), whose formula is the following: Paris green, 1.2 lbs.; liquid ammonia at 22°, 1.8 lb.; brown molasses, 10 lbs. ; water, 30 gallons. This mixture has some marked disadvantages, not compensated for by its quick action and adhesive properties. Commercial ammonium arsenite has not been tried.

3) Barium chloride in 4 per cent. solution has given excellent results. This insecticide is easy to prepare, is less dangerous for the men and does not clog the nozzles ; but it is much too dear, is easily washed off by rain, and does not show up on the sprayed plants.

4) Sodium arsenite, long used in South Africa, was first tried in Turkestan in 1911 ; it was so successful that it is now the only substance used on a large scale. The best strengths for the different stages of the larvae are as follows : 1st and 2nd stages, 0.25 per cent; 3rd stage, 0.37-0.4 per cent. ; 4th stage, 0.5 per cent. Perfect adhesiveness is obtained by adding double the amount of mollasses (brown sugar) in each case. Thus prepared, the insecticide is not readily washed off by rain and acts on the larvae in an astonishing way : a mortality of 100 per cent. is obtained in the 24 hours following the application. Sodium arsenite comes cheaper than Paris

green, gives a higher mortality, acts more quickly, sticks to the plants better (used with molasses), and is easier to apply ; on the other hand, it scorches the vegetation and is more dangerous to handle, but these slight disadvantages are not enough to outweigh the advantages mentioned.

5) Other arsenical compounds, soluble and insoluble, tried in Turkestan, have not given decisive results.

b) *Contact washes.* — These have also been tried, but without much success ; in particular soft soap solutions at 3.3 per cent. were recommended by some entomologists, such as Rossikof and Schreiner ; experiments on a large scale have shown that they are not reliable. Contact washes present no advantage over scorching. Various other insecticides, like ordinary soap, paraffin emulsion and certain complicated mixtures, have given no better results.

c) *Hopper dodgers.* — These machines, successfully used in America, Australia and Russia, have been tried in Turkestan. They consist of large plates of wood, sheet-iron or canvas, drawn by horses, and smeared with petroleum or bitumen ; the larvae jumping out of the way fall onto these plates and are caught by the sticky material. Hopper-dodgers are only useful for the destruction of small colonies of locusts, as they do not catch enough to deal with the large invasions frequent in Turkestan. Further, they can only be used in perfectly level places free from vegetation.

This study of all the methods tried on a large scale in Turkestan allows one to select the most convenient and advantageous for each particular case. The Russian entomologists in charge of the work of destruction in this vast region at present use the plan detailed below; they have succeeded in reducing the enormous damage caused by locusts to almost nothing. Turkestan has been almost completely freed from these dangerous pests, and since 1911 the work has been largely confined to exterminating certain centres of small importance which appear here and there near the frontiers of Persia and Afghanistan. The plan is as follows : 1) preparation in summer and autumn of forecast maps, showing the position area and density of the egg centres of each district; 2) treatment of the infested area with Paris green, or better, molassed sodium arsenite, as soon as the larvae appear; 3) scorching by knapsack machines of larvae in places not accessible to sprayers, devoid of vegetation or far from watercourses of sufficient capacityto keep the sprayers going regularly ; 4) capture of larvae in pits or ditches.

Natural Enemies of Locusts.

Among birds, the chief locust-destroyer in Turkestan is the rose-coloured starling (*Pastor roseus*) ; these birds nest in the mountains and come down in enormous flocks to follows the colums of larvae, as well as the flights of adults, which they often kill on the wing in large quantities. This species is undoubtedly a precious ally, but in regions of organized control it often complicates the work ; it would therefore be risky and unreasonable to rely on regular assistance from these birds, and especially to include such an in-

constant element in the plans for destruction. The sparrow also hunts locusts, and some writers believe that, like the pastor, it destroys the larvae simply for the pleasure of killing them. Ravens and crows take chiefly the eggs, which they dig out of the ground in late summer and autumn; they are made use of by the entomologists to discover the chief centres of egg-laying for indication on the forecast maps. The destruction of eggs by crows is in some regions helped by certain species of lizards, of the genera *Eremias* and *Phrynocephalus*.

Entomophagous insects attacking locusts are few in number in Turkestan. Among predatory ones may be mentioned certain species of *Callistenes*, which devour the larvae, and *Prosodes*, *Adesmia*, *Stalagmoptera* and certain Elaterids (? *Athous*), which feed on the egg-clusters. The true parasites develop in the eggs, the larvae or the adults. It has been found that species of locusts inhabiting districts with rich vegetation suffer more from the attacks of parasites than those which pass several stages of their development in districts where vegetation is scanty.

The Marocco locust in Turkestan is attacked almost exclusively by endophagous parasites, among which *Callostoma desertorum* is the most important; then come its near ally *Mullio obscurus* F., and a Meloid, *Zonabris 4-punctata*. The larvae bore into the egg-cases immediately after laying, and undergo all their metamorphoses there. They are very numerous in places frequented by the locusts several years in succession; the larvae of *Callostoma* and *Mullio* alone may destroy 40 per cent. of the eggs, while those of *Zonabris* account for hardly 2 per cent.

The egg-clusters of the Marocco locust are also subject to attacks of certain fungi not yet properly studied; these may reduce considerably the number of larvae hatching. The introduction of the fungi is evidently assisted by the attacks of birds and is favoured by moisture in the soil; they are so important that account has to be taken of them in drawing up the plan of campaign: when the forecast maps are prepared, it is customary to note the degree of infection of the eggs by animal parasites, but the fungi may so much alter the situation during the winter and in early spring, that centres very rich in autumn may give no hatching in spring. Miscalculations of this sort have not infrequently arisen, and in such cases parties sent to the places at great expense were kept idly waiting for the eggs to hatch for several weeks, when they might have been carrying out useful work in districts really in danger. For the forecast maps to provide reliable information, and thus to fulfil their purpose, it would be necessary to verify the state of the eggs in the spring before hatching began and make careful notes of the centres no longer dangerous; in this way much annoyance and useless expenditure would be avoided.

The importance of the natural enemies, in particular the endophagous parasites, cannot be doubted; it is certainly to them that must be attributed the almost complete disappearance of the locusts in certain years. But the value of this factor must not be exagerated in arranging the plan of destruction, for the conditions of development of these organisms are as yet little understood, and a large multiplication of them only takes place after re-

peated invasions of the locusts in a particular area. It is evident that the exigencies of modern agriculture are not compatible with such a state of affairs, for the simple reason that before the appearance of the parasites the crops will be devastated several times ; it is much more logical and easy to get rid of these dangerous enemies as soon as they appear than to count on the assistance of an element so vague and inconstant as the natural enemies.

Breeding of parasites on a large scale with a view to their utilization for destroying locusts, has not been attempted in Turkestan. Last year experiments were made with *Coccobacillus Acridiorum* d'Hérelle; when administered after passage through locust hosts it gave a heavy mortality, but contaminated grass gave no decisive results. This method is still being studied.

Economic Importance of Locusts in Turkestan.

We have already remarked on the special reasons for protecting the crops in Turkestan from locusts. The figures given in the accompanying table show the importance of the damage, the loss to the local population, the sums expended by the Locust Control Administration, and the results obtained.

Losses due to locusts in Turkestan.

Year	Area of egg-laying centres — acres	Area of crop destroyed — acres	Estimated value of crops destroyed — francs	Days of labour required for the control	Total loss to the population — francs	Expenditure for the control — francs
1901	54 793	344 981	7 853 300	2 905 778	11 480 975	114 250
1902	184 668	259 060	5 895 000	5 054 789	12 217 350	509 875
1903	179 034	126 280	2 872 500	1 714 857	5 018 082	435 140
1904	259 426	59 238	1 348 437	1 470 276	3 186 280	417 212
1905	114 357	23 414	534 000	601 333	1 284 790	601 964
1906	42 543	0	0	0	0	468 887
1907	20 239	702	insignificant	0	insignificant	130 700
1908	25 428	4 112	106 125	419 295	811 080	27 500
1909	55 764	58 776	1 337 925	592 000	2 077 385	200 000
1910	226 233	8 451	217 375	391 175	706 342	1 198 412
1911	218 531	0	insignificant	0	insignificant	1 446 547
1912	0	0	0	0	0	?

INSECTS INJURIOUS TO VARIOUS CROPS.

394 – **Insects in Flour Mills and Granaries.** — Dean, George A. in *Kansas State Agricultural College, Agricultural Experiment Station Bulletin*, No. 189, pp. 139-236, figs. 1-56. Manhattan, Kansas, 1913.

The writer describes numerous experiments on the cleansing of mills from injurious insects by means of high temperatures, and discusses another series of experiments on the destruction of insects infesting flour and stored

grains by means of fumigation with hydrocyanic acid gas and carbon disulphide. The damage caused by insects to stored grain in the U. S. A. amounts to 5 per cent. of its value.

Lack of supervision and cleanliness are the causes of the large increase of insects in mills and granaries. It is very important to sweep up all the waste flour from the floors, corners, under machines, etc. The application of high temperatures is the only efficacious and practical method so far known for destroying these insects. This method has developed to such an extent of recent years that it seems likely to revolutionise the comparatively inefficient methods at present in use. The heating of various mills in Kansas has given absolute proof that these insects cannot resist the heat in any of their stages, even in the most inaccessible places. This system has also been employed with success in several mills in Ohio, Illinois, Nebraska, Iowa, Indiana, the south of Canada, etc. The heat penetrates throughout, through obstacles and into the remotest corners where gases could not reach the insects. Many insects can resist the effects of hydrocyanic acid for a long time, but none can resist a temperature of 118 to 122° F. for even a short time. Fumigation with hydrocyanic acid requires 2 or 3 days, thus involving considerable expense in the long closing of the mill and the cost of the necessary material, not to speak of the danger to the operators. If the heating system is applied from Saturday to Monday morning no time is lost, the cost is small and there is no danger to the operators. In a mill which can be warmed to a temperature of 70° F. in winter, it is easy to obtain a temperature of 118 to 122° in summer. By this method no damage is done to the flour, the belting or machinery, and there is no danger of fire. It is recommended by the " Mutual Fire Prevention Bureau ", which represents eight of the principal millers' assurance companies.

Mills infested by *Ephestia kuehniella* Zell. (Mediterranean Flour Moth) may be effectively treated with hydrocyanic acid, but this method is not recommended if the heating system can be applied.

The simplest, the most effective and the least costly remedy against insects infesting grains and their products stored in warehouses is careful fumigation with carbon disulphide. In well closed buildings in which the temperature is about 70° F., 4 ½ lbs. of carbon disulphide is sufficient for about 1000 cu. ft., and about 1 lb. for every ton of grain. It is not an effective disinfectant for flour mills, and for such places is not recommended owing to the danger of fire.

395 – **The Florida Fern Caterpiller *(Eriopus floridensis)* in the United States.** — CHITTENDEN, F. H. in *U. S. Department of Agriculture, Bureau of Entomology, Bulletin* No. 125, pp. 11, 1 fig. Washington, 1913.

During recent years a considerable number of caterpillars of *Eriopus floridensis* Guén. have appeared in the District of Columbia, in Illinois and in Ohio. The insect is indigenous to Florida and Tropical America. It has caused serious damage to ferns growing under glass.

The writer describes the life-history of the insect. The eggs and the early larval stages have not been observed. The larvae feed chiefly dur-

ing the night, resting at the base of the plant during the day-time. They cause serious damage to ferns at all seasons of the year. The cocoons are attached to fragments of leaves and other soil rubbish, near the level of the ground. The pupal stage lasts from 23 to 27 days.

Some of the natural enemies of the insect are *Ichneumon extrematis* Cress, *Sargaritis* sp. and a Tachnid not identified.

As means of controlling this insect, a decoction of hellebore, poisoned baits and carbon disulphide have given good results. Arsenate of lead would be effective, but it reduces the value of the plants by covering them with a white layer. The best method is hand picking the larvae which fall to the ground when the plants are shaken. Fumigation with hydrocyanic acid has not been much used, but should give effective results.

396 – **The Rose Slug-Caterpillar *(Euclea indetermina)* in the United States.** — CHITTENDEN, F. H. — *U. S. Department of Agriculture, Bureau of Entomology, Bulletin* No. 124, 9 pp., 1 fig. Washington, 1913.

It is only within recent years that the slug-like caterpillar of *Euclea indetermina* has been known to injure the rose. It has already been observed on plum, oak, chestnut, hiccory (*Carya*), pawpaw (*Asimina triloba*), bayberry (*Myrica cerifera*), flowering dogwood (*Cornus florida*), apple pear, wild cherry (*Prunus* spp.).

All writers seem to agree in stating that the larvae mature during September, but the specimens which were received from West Virginia had matured by August 20.

Eggs are deposited during July, in small groups slightly imbrecating or overlapping, and hatch in about nine days. The larvae pass through eight stages, and occasionally nine, before transforming to pupae, and it has been observed that in stage I, which is passed rapidly, they take no nourishment. The species hibernates in its cocoon, and the moth has generally been observed to issue in July.

In case only a few rose bushes or young trees are attacked, hand-picking is ample for controlling this insect, the precaution being taken to use a glove, thus avoiding being " stung ". Should the caterpillars appear on several plants, they should be sprayed with Paris green or arsenate of lead.

397 – **Diptera injurious to Cabbages.** — SCHWARTZ, MARTIN in *Mitteilungen der Deutschen Landwirtschafts-Gesellschaft*, Year XIX, Part 7, pp. 98-100, figs. 1-2. Berlin, February 14, 1914.

The writer refers to all the Diptera injurious to garden crops, and deals specially with those attacking cabbages : *Chortophila brassicae, Anthomyia floralis, A. radicum, Phaonia trimaculata.*

For the control of *Chortophila brassicae*, chemical substances have not yet given good results. The chief preventive measure is careful examination of the young plants before setting out and elimination of all showing infection. A second examination should be made within a fortnight, and all attacked plants should be destroyed ; before replanting, the vacant spots should be well beaten down and treated with insecticide, to destroy any larvae in the ground. In this way the first generation can be got rid off.

Another important point is to burn the stalks after the cabbages are cut. Fresh manure should not be used. Seedlings grown in frames should be covered with netting to keep off the flies.

398 – **The Grape Leaf-Hopper *(Typhlocyba comes)* in New York State.** — HARTZELL, F. Z. in *New York Agricultural Experiment Station, Bulletin* No. 359, pp. 31-51, figs. 1-3, plates I-VI. Geneva. N. Y., 1913.

A large number of adults of *Typhlocyba comes* Say. survived the winter of 1911-12 and threatened many vineyards, but fortunately weather conditions during the summer were unfavourable for the nymphs, causing a decrease of the insects during the late summer and autumn of 1912.

The most favourable hibernating places for the leaf-hopper are fence rows, woods, brush and waste land, weeds and places where leaves accumulate. The drier, well-drained soils are more conducive to the safe wintering of the adults than the heavier soils. The foliage of raspberry, strawberry, blackberry, currant, gooseberry, catnip (*Nepeta Cataria*), Virginia creeper, burdock, beech and sugar maple is eaten by the hopper before it migrates to the foliage of the grape. The strawberry and raspberry are the favourite spring food-plants, the insect migrating from the strawberry to the raspberry during early May and from the raspberry to the grape during the latter part of May.

Mating of the hibernated adults takes place on the spring food-plants. The foliage of the grape is injured by the overwintering adults, but most of the feeding is restricted to the lower leaves, especially those of the young shoots or suckers at the base of the vine. The amount of injury to vineyards varies directly with their proximity to favourable hibernating places and spring food-plants.

Spraying experiments during 1912 showed that a solution of 1 part of 40 per cent. nicotine ("Black leaf 40") in 1600 parts of water or Bordeaux mixture is an efficient spray for the leaf-hopper. The fruit from vines protected from the leaf-hopper is superior to fruit from vines subjected to the attacks of this pest. Chemical analyses of grapes from sprayed vines gave a gain of from 8 to 68 per cent. in sugar over those from untreated vines, while the unsprayed grapes had from 0 to 20.6 per cent. more acid than sprayed grapes.

The destruction of hibernating places of the grape leaf-hopper is recommended as a method of control, especially to save the young foliage of the grape in the spring. When hibernating adults are on the young foliage, delaying the removal of the young shoots at the base of the vine will tend to keep the insects on the lower leaves and thus afford some protection to the more permanent foliage. The lower shoots should be removed just previous to spraying.

9 – **The Control of the Codling Moth in the Sacramento Valley, California.** — WOODWORTH, C. W. in *University of California, College of Agriculture, Agricultural Experiment Station, Berkeley, Circular* No. 101. 4 pp., 3 figs. Berkeley, June 1913.

In contrast with the conditions prevailing in the Pajaro Valley, codling moths appear in the Sacramento Valley early in spring and are ready to begin egg-laying before the fall of the blossoms of the apple and pear. Egg

laying is concluded in about a month. The eggs hatch in about 8 ½ day and the young larvae are abundant in the apples by the time they are as larg as peas; they remain in them for about 27 days. The pupal stage lasts month, and the moths are out by the middle or latter part of July.

A second generation occurs during August and September, and a fe of the more precocious are able to produce a third generation in the autum Usually the worms of the second generation go into hibernation as soon a they have spun their cocoons and do not transform till the following spring

Most of the apples grown in the Sacramento Valley are early fruit, whic is ready to harvest early enough to escape the attack of the second broo of worms. Where nothing is done to protect the fruit the worms injur two-thirds of the crops. If the orchard were isolated and all the fruit re moved at this time, the second generation might be largely annihilated b starvation.

Pears are more largely grown in the Sacramento Valley than apples, an are not usually seriously affected by the first brood of worms (less than 1 per cent.), but if not controlled the worms of the second generation injure third of the crop. The usual method of harvesting pears removes the large proportion of the worms of this second generation from the orchard; henc the relatively small injury from the first generation of the following year.

The gathering and destruction of fallen fruit was formerly required b law in California. Twenty years ago the placing of bands of old grain sack round the trunk and examining them once a week or once a fortnight wa found more effective. A parasitic wasp imported from Spain was foun to be of no practical value.

The use of arsenical poisons has come to be the sole metho for the control of this insect. All who have investigated the subject agre that the poison must be applied before the worms enter the fruit, and thorough application is necessary for the best results. Both the life his tory and observations of the results of practical spraying work indicat that the time for the first application in that valley is as soon as possibl after the petals fall.

In the case of pears or autumn apples, unless this first spraying ha been very thorough, the second brood will require attention during th latter part of July or early in August. For this purpose the placing of bands o sacking about a few of the trees is recommended, and these should be exa mined about the 1st and 15th of July and August.

One thorough spraying for summer apples and one or two for autum apples and pears will completely control the codling moth in the Sacrament Valley. The writer gives the following formula for an orchard of about ¼ acre of average-sized trees:

Lead arsenate.	3-6 lbs.
Water.	100 gallons.

Zinc arsenite may be substituted for arsenate of lead, using about one third as much (1-2 lbs. for 100 galls. of water), or Paris green ($\frac{3}{4}$-1½ lb. i

100 galls). In the latter case it is usual to add about three times as much lime. This serves two purposes, holding the arsenical poison on the tree and marking the tree so that one can be sure of the thoroughness of the application.

400 – **Small Ermine Moths *(Hyponomeuta malinella* and *H. padella)* in the United States.** — SCHOENE, W. J. and PARROT, P. J. in *New York Agricultural Experiment Station, Technical Bulletin*, No 24, 40 pp., 10 figs, map, 9 plates. Geneva, N. Y., 1913.

Hyponomeuta malinella and *H. padella* were found in numbers in the State of New York in 1909, probably imported on infected stock. They are now found in many districts, *H. malinella* on apples and *H. padella* on whitethorn and plums.

In the Unites States the moths appear in the first fortnight of July, and egg-laying begins about the middle of the month. The larvae, after hibernation, feed till the second half of June, and then pupate.

These species seem to be largely free from the numerous parasites which attack them in Europe ; but an Ichneumonid (*Mesochorus* sp.) has been bred from *H. padella* on cherry, while a Tachinid (*Exorista arvicola* Meigen) has been found abundant in some colonies of *H. malinella*.

The chief means of control are careful inspection of nursery stock in June, and arsenical spraying.

ALFREDO RUGGERI, *gerente responsabile*.

FIRST PART.

ORIGINAL ARTICLES

Present Status of Agricultural Education in Canada

by

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Jurisdiction of the federal and provincial Governments.

By virtue of the British North American Act passed by the British Parliament under which the provinces become a federation known as the Dominion of Canada, concurrent power of legislation with regard to agriculture is exercised by the Federal and Provincial Parliaments. The Federal Parliament may make laws concerning agriculture in any or all of the Provinces, and any law of the legislature of a Province relative to agriculture shall have effect in and for the Province so long as and as far only as it is not repugnant to any Act of the Parliament of Canada.

Education in its restricted sense, including the teaching of agriculture in the schools, is the exclusive prerogative of the Provincial Governments. However, in its broader sense of educational agencies other than the regular schools, concurrent power is exercised by the Dominion and Provincial Governments. Sometimes, moreover, there is a certain measure of collaboration between them.

The agricultural instruction act, 1913.

The passing of the *Agricultural Instruction Act* 1913 by the Dominion Parliament during its last session, at the instance of the Minister of Agriculture, Hon. Martin Burrell, is the most momentous event that has occurred in the history of agricultural education in Canada in recent years. From it a great impetus for agricultural education has been generated. This encouragement lies in the favorable sentiment awakened by the Federal Parliament's action perhaps as much as in the generous vote of money.

By the terms of the Act the sum of $10,000,000 is set aside for distribution amongst the provinces during the next ten years on a *pro rata* of population basis. While the expenditure of the provincial grants is entirely in the hands of the provincial authorities, the approval of the Federal authorities is first necessary for any proposed outlays.

No restricting provisions appear in the Act. Any commendable line of effort that the provincial Departments of Education and Agriculture may desire to carry out will be supported. It aims to strengthen all lines of instructional and educational work already under development. Many of the undertakings mentioned below as being carried out by the different provinces have been initiated or are being made possible of development because of the support of this Act. In every part of Canada its influence is being felt.

Instruction through agricultural organizations.

It is rather difficult to define the term " agricultural instruction ". Ordinarily the word " instruction " is restricted to the work of schools and teachers, but in agriculture other agencies may be and often are considered as educational agencies. These agencies are more numerous perhaps in the Province of Ontario than in the other provinces of Canada although they are more or less represented in them all. Their objects are educational ; they seek to promote some particular branch of agriculture or farm life through shows, competitions, annual meetings, printed reports and courses of lectures. They are designated as Associations, Societies, Institutes and Unions. Of those called Associations there are the Vegetable Growers', Fruit Growers', Bee Keepers', Corn growers', Cattle Breeders', Sheep Breeders', Swine Breeders', Horse Breeders' and Dairymen's. Of those called Societies there are Agricultural, Horticultural and Entomological. Of the Institutes there are the Farmers' Institutes and the Women's Institutes. The Agricultural and Experimental Union is another educational organization. All of these receive funds from the provincial treasuries and are under the supervision of the Departments of Agriculture. Besides these organizations, numerous Farmers' Clubs, and Boys' and Girls' Clubs have come into existence within the past few years and may be considered as educational factors in agriculture. There are very few parts of the country where at least one of the organizations is not represented. Their membership is made up of the most progressive people as a rule although there are still many people to be reached by them. Demonstration trains too have in recent years taken instruction and demonstrations to the farmers; they are operated jointly by the railroad and the Departments of Agriculture.

Under the support of the Dominion Department of Agriculture there are other organizations doing educational work such as the Dominion Experimental Farms, the Dominion Seed Growers' Association, the Forestry Association and Cow-Testing Associations. Some of the different branches of the work of the Department are under the direction of special officers called Commissioners. There are a Live Stock Commissioner, a Seed

Commissioner, a Dairy and Cold Storage Commissioner. It has also a special Publications Branch which looks after the publication and distribution of all reports, bulletins and circulars.

These organizations and officers of the Dominion Government work hand in hand with the Provincial organizations and officers. Their work is carried out so as to supplement and help and not to overlap the provincial work. There is friendly co-operation along all lines. The Experimental Farms located at strategic points throughout the Dominion, besides teaching thousands of farmers by actual demonstrations, distribute valuable planting material and reports, and send out members of their staffs to lecture at farmers' meetings. The Seed Growers' Association, besides training its members in the growing of selected seed, further serves the farmers' interests by securing and distributing such seed. The Dairy and Cold Storage Branch organizes and supervises Cow Testing Associations throughout the Dominion, being assisted in this by the provincial authorities. The Seed Branch looks after the administration of the *Seed Control Act* through which farmers are protected from impure seed ; in its laboratories, seed for planting is tested for purity and germibility and reported upon to the individual farmer. The Live Stock Branch serves in its own field in all the different provinces.

In every phase of its activity the work of the Dominion Department of Agriculture is educational. It has taken no small share of the work of instructing Canadian farmers in scientific agriculture. As time goes on its work increases.

Ontario.

In the Province of Ontario, there is at the head of the schemes for agricultural education, the Ontario Agricultural College located at Guelph. It has been in operation for thirty nine years. In 1902 the Macdonald Institute was established and made part of the College. In this there are Departments of Home Economics, Manual Training and Nature Study organized to train teachers and to promote these subjects in the schools, and in the case of the Home Economics Department to give to girls from the farms training in cookery, sewing, laundry work, etc. The Ontario College is the mother amongst the Agricultural Colleges of the Dominion. The other Colleges resemble the parent college in many of their features.

The regular work in Agriculture has two aims or conclusions. Students attending two years receive diplomas as Associates of the College; the work is adapted as far as possible to the practical needs of the farmer in his everyday work and problems. A further attendance of two years leads to a graduation as a Bachelor of the Science of Agriculture (*B. S. A.*) granted by the Provincial University. The last two years' work takes the student further into the scientific study of the subject. The College constitutes part of the University of Toronto.

Much instruction is given in short courses. These are held throughout the year. They include a three months' course for cheesemakers and buttermakers (another Dairy School serving the eastern part of the Province

is located at Kingston), a two weeks' course on seed and cattle judging, a four weeks' course in poultry keeping, two weeks' course in fruit growing and bee keeping, a ten weeks' spring course for Normal teachers, three months' courses in domestic science and domestic art, five weeks' courses for public and high school teachers, besides shorter courses for school inspectors, judges of field crop competitions, milk inspectors, ice cream manufacturers and travelling dairy instructors. In the month of June the College is given over to the entertainment and instruction of thousands of members of Farmers' Institutes which arrange excursions.

During the past six years there has been a marked growth in the work of the so-called District or County Agricultural Representatives. From six appointed in 1907, the number has grown to thirty-seven. These young men are all graduates of the Agricultural College, holding the degree of B. S. A. From central locations in their counties they carry on many diverse lines of activity. These include holding short courses in the local High Schools, teaching elementary agriculture to the regular High School classes, holding seed and stock judging courses out in the country, organizing Farmmers' Clubs, Township School Fairs, Egg-Collecting Circles, Pure Seed Clubs for growing, selling or buying improved seed, visiting farmers on their farms, teaching lessons in country schools, carrying out co-operative experiments on fertilizers, demonstrating modern orchard management, lecturing at Farmers' and Women's Institute meetings, making drainage surveys for farms.

In the elementary schools the teaching of agriculture has been making satisfactory advances. It is under the charge of an officer of the Department of Education designated as the Director of Elementary Agricultural Education. No text book is prescribed; the work is based on Nature Study and School Gardening. Teachers are specially trained in spring and summer courses at Guelph receiving the *Elementary Certificate in Agriculture*. Special grants are paid to teachers and trustees undertaking the work. The work is optional but public sentiment in favor of it is growing steadily. One hundred and eighty schools entered for the work in 1913 to qualify for the special grants. Many other schools are conducting school gardens and giving some instruction in agriculture without engaging to fulfil all the requirements for the special grants. Through the Schools' Division of the Experimental Union, choice planting material is furnished free to the schools for experimental and demonstration purposes. During the past season Field Agents in Agricultural Education assisted the Director of the work in supervising and inspecting the work in these schools, besides giving instruction at Teachers' Institutes and the Model Schools where teachers are trained. At the Normal Schools also, teachers receive instruction in Elementary Agriculture and School Gardening.

In the High Schools besides the short courses given by th County Agricultural Representatives a commencement has been made this year to introduce agriculture as a regular subject along lines similar to the Public School work. Teachers are specially trained for the service at a summer school held at Guelph, receiving the *Intermediate Certificate in Agriculture*.

Special grants are given to them and to the trustees. Two schools have commenced the undertaking. The subject is optional but an examination is held on it and the marks obtained added as a bonus on teachers' qualifying certificates.

Quebec.

In Quebec, Macdonald College located at Ste. Anne de Bellevue, near Montreal, stands at the head of the schemes for agricultural education, particularly for the English speaking population of Quebec. Besides this, there are smaller French colleges located at Oka and Ste. Anne de la Pocatière. The Agricultural Institute of Oka, as it is called, is affiliated with Laval University and gives a four year course leading to the degree of B. S. A.; it is in charge of the Trappist Monks, four or five of the fathers or brothers being professors in the school. The school at Ste. Anne is of more recent establishment than that at Oka.

Macdonald College is affiliated with Mc Gill University and graduates receive from it the degree of B. S. A. after a four years course. As in the Ontario College, there is a two years course for the Associate Diploma. A School of Domestic Science and a School for Teachers are comprised in the College. The School for Teachers takes the place of the McGill Normal School which formerly carried on the teacher-training work for the English schools. Within the past year arrangements have been made whereby agricultural students of the two or four years courses, by taking special instruction in pedagogy and practical teaching, receive certificates entitling them to teach in the English rural or urban schools. A special propaganda has been carried on also aiming at the consolidation of rural schools. Besides training teachers in agriculture, the College also issues leaflets on agricultural topics for use by the pupils in the rural schools.

District, or Agricultural, Representatives carrying on work similar to that in Ontario have been appointed in Quebec also. Six of these are under the charge of Macdonald College, and five are working amongst the French population and connected with the Provincial Department of Agriculture.

In the French elementary schools instruction is given in agriculture by means of a text book, " L'Agriculture dans les Ecoles". This has been in use for about eighteen years. In some localities school gardening has been commenced under the encouragement of the District Representatives in some cases. For 1913 there were 234 schools located in 53 counties reported as carrying on this work. In further support of the introduction of the subject it is proposed to give students attending the Normal Schools theoretical and practical training in such branches as dairying, poultry-husbandry and horticulture, also to encourage teachers and schools to take it up by offering special grants of money.

Nova Scotia.

In the Province of Nova Scotia, the Agricultural College located at Truro, stands at the head of the work in agricultural education. Besides Nova Scotia this College has been serving the needs of the two other

maritime provinces of New Brunswick and Prince Edward Island. The work carried on corresponds to the first two years for associate standing at the Macdonald College and Guelph and accredited graduates are admitted to the third year work of these larger Colleges.

The provincial Normal College, also located at Truro, is closely associated with the Agricultural College, and teachers-in-training have the advantage of instruction from members of the College Staff. A special faculty has been organized for the training of teachers for service in " Rural Science Schools ". At such schools gardening is carried on under teachers holding the *Rural Science Diploma* in whole or in part. Special grants are paid to teachers and trustees for the work, the amount depending on the grading of the schools' effort as " fair ", " good ", or " superior ". A Director of Rural Science Schools has been appointed to supervise the work throughout the province. For teachers actively engaged in teaching, a Summer School is held at the Agricultural College to train candidates for the Rural Science Diploma. Thirteen teachers from New Brunswick attended the School in 1913, receiving special grants from the Government to cover part of their expenses.

New Brunswick.

For the Province of New Brunswick the instructional needs in agriculture have been met hitherto by the Nova Scotia Agricultural College at Truro. During the past year, however, the Fisher Vocational School has been built at the town of Woodstock and through its agricultural department a commencement will be made early in 1914 with short courses in agriculture. This school has been built under a bequest but the expense of conducting the institution will be met by the Government. Besides the winter short courses, a Rural Summer School will be held at the Woodstock School in July. This will be for the purpose of training teachers in School Gardening and Elementary Agriculture. Those who put their instruction into successful practice afterwards in their schools will receive special grants therefor. The agricultural work in the schools is in charge of the *Director of Elementary Agricultural Education.* Besides the school at Woodstock, another agricultural school is planned for the southern part of the Province, at Sussex.

Prince Edward Island.

During the year 1913 agricultural instruction in Prince Edward Island has developed chiefly in connection with Prince of Wales College. A winter short course in Agriculture for farmers was carried out at the College, including Domestic Science instruction for farmers' wives and daughters. The regular students at the College receive instruction in Agriculture also; this is given by members of the staff of the provincial Department of Agriculture. There is also a Summer School for Teachers held at the College, training in School Gardening and Elementary Agriculture.

Two District Representatives are members of the staff of the Department of Agriculture, one serving the Island west of Charlottetown and the other the eastern part.

Manitoba.

In the Province of Manitoba the Agricultural College having outgrown the quarters originally provided for it, took possession of its new and enlarged quarters on a new site near Winnipeg. The new College is planned on a magnificent scale. No expense has been spared to provide the very best of equipment and buildings. During the first term over 300 students enrolled and it is expected that this number will be increased largely. At this College all teachers from the provincial Normal School receive a month's training in Agriculture, either before or after the regular normal training.

The agricultural work of the schools is under the direction of an officer of the Department of Education designated as *Director of Elementary Agriculture, School Gardening and Nature Study*. School garden work and the teaching of agriculture are compulsory in the schools.

In 1912 Agriculture was introduced into one of the High Schools under a special teacher, a graduate of an Agricultural College. This year there are five schools with Agricultural Departments, in charge of such teachers. This number will soon be increased. These teachers serve under the Department of Education but otherwise carry on work similar to the Agricultural Representatives in other provinces.

Under the Extension Service of the College, Children's Club work is promoted.

Saskatchewan.

The provincial College of Agriculture for this Province is located at Saskatoon. In 1912, the first year of its operation, there were sixty-four students in the first year of the certificate course. For the fall term of 1913 it was expected there would be a total enrolment of about one hundred and twenty students in Agriculture.

In the schools the subject of Agriculture is prescribed for Grades VII. and VIII. and also for the grade VIII. diploma which is the high school entrance requirement. For a third class teacher's diploma the subject is compulsory. There is no text book prescribed by the authorities ; instead there is a list of recommended reference books for the teacher's use.

Steps are being taken to provide for the training of teachers in Agriculture at the two provincial Normal Schools as well as at the Agricultural College.

For the promotion of agriculture throughout the Province, Agricultural Secretaries are appointed by the municipalities. Amongst other duties they act as weed inspectors. There are about eighty of these officers at the present time. They are especially instructed in short courses at the Agricultural College. When the proposed Agricultural Representatives are appointed these Secretaries will likely serve under them.

Alberta.

The Province of Alberta has proceeded in its development of Agricultural Education along lines different from those followed in most of the other

provinces. Instead of commencing with an Agricultural College, provincial *Schools of Agriculture* have been organized. In 1913, three of these began operation ; they are located at Vermilion, Olds and Claresholm, separated thus to serve three more or less dissimilar districts. The instruction covered corresponds to the first two years of the Manitoba or Ontario Agricultural College. Domestic Science is taught in addition to Agriculture. It is expected that more schools will be started and, as the work develops, an Agricultural College will be established as a part of the Provincial University, completing the course of instruction in Agriculture for the degree of B. S. A.

The work in the schools is encouraged also along lines somewhat similar to those followed in Saskatchewan. A Summer School to train teachers was held in 1913 at the University of Alberta, Edmonton. Eighty-five teachers were in attendance. This will be continued and extended. The Legislature has made provision for special grants for the encouragement of agriculture and school gardening. With these two factors in operation rapid advancement of agricultural teaching is expected.

British Columbia.

Up to the present there has been no school or college of agriculture established in British Columbia. The question of the establishment of an Agricultural Department in the provincial university now under process of organization is receiving favorable attention, however.

In the schools there is no definite work prescribed other than the encouragement of school gardens and Nature Study. In some places the local Women's Institutes are assisting teachers in the gardening work. The Department of Education is planning for an extension of the work in both the public and high schools and will submit a bill to the Provincial Legislature for this purpose in the first session of 1914.

In furtherance of the fruit interests the Department of Agriculture has seven Assistant Horticulturists located throughout the province acting in somewhat the same capacities as the Agricultural Representatives of the other provinces. Their work is confined, however, to horticultural interests ; they do not take any work in the schools.

Present State of Agricultural Education in Germany

by

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There are three kinds of institutions in Germany which deal with agricultural education :

a) Academic institutions in which research work is also conducted.
b) Secondary agricultural schools.
c) Primary agricultural schools.

Besides the above there are a large number of local continuation schools, schools of domestic economy, travelling lecturers and continuation courses for the spread of general and special knowledge in agriculture and domestic science and their allied branches.

In view of the available time and space it has been impossible to give figures for the whole of Germany. Therefore only the principal statistical data relating to agricultural education in Prussia and, as far as possible, the number of the various educational institutions in the other German states of the confederation, have been given in *Table I*. It should be pointed out that, owing to uncertainty of some of the material and to the nomenclature of the schools being frequently different in the various States, errors may have crept into the classification of individual schools. The table shows the numerical prevalence of secondary and primary schools corresponding to the greater number of medium and small sized farms. These absolute figures, however, unaccompanied by the numbers of the farms of different sizes etc. do not give much information as to how far the educational requirements of the various classes of farms are provided for. It can safely be assumed, however, that the primary and secondary schools are is still far from being sufficiently numerous.

The establishment of secondary and primary agricultural schools was taken in hand much later than that of academical agricultural institutions, and for this reason they do not yet meet the demand everywhere. At least 78 per cent. of the cultivable area of Germany is cut up into small farms for the holders of which the secondary and primary schools are the most suitable. It would therefore be most important to increase still further the lower grade schools in order to increase the production of the largest portion of the surface of the country. To the same end it would be advisable to increase the number of travelling lecturers and of demonstration fields which induce smaller farmers to adopt recent improvements by means of object lessons.

The introduction and rapid development of instruction in domestic economy is very satisfactory, as good domestic management on the part of the women is an essential factor of the financial success of the whole farm, especially in medium sized and small holdings. In this connection also further progress is very desirable.

Academical instruction and research has undergone many transformations during the last two centuries. It is at present an organised study in the curriculum of the great centres of learning, especially the Universities. At the same time agriculture appears also as a section of a technical college (Munich) and in independent colleges (Berlin and Hohenheim), and also in the form of agricultural academies (Poppelsdorf and Weihenstephan). Of late an experiment has been made besides in Bromberg, of creating a seat of higher agricultural research on American lines where continuous instruction is not obligatory.

Which of these forms is the best is still an open question as each of them has its advantages and disadvantages. From a purely financial point of view, independent colleges appear to be the most expensive form of

academical agricultural education, but this of course is no decisive argument as many other weighty factors have to be considered.

With regard to the secondary schools, an experiment has lately been made in Prussia with a new form of school, the agricultural seminary, probably because the older schools have not adequately filled the gap between lower and academical education. Whether these new intermediate schools will give good results and eventually supplant the older schools, cannot yet be foreseen.

The general and special courses of continuation lectures for farmers similar to those long held for other professions. *i. e.* medical men, schoolmasters etc. enjoy increasing favour. They also give older farmers the opportunity of becoming acquainted the recent progress in agricultural science with the least expenditure of time and money.

In order to give some numerical data on the institutions of different degrees of agricultural education in Germany, on the cost of their upkeep and the number of students enrolled, the principal figures for Prussia are given in *Table II*. They have been kindly furnished by Prussian Ministry of Agriculture from the statistics of agricultural education in Prussia for 1909-1911 which are still in the press. In this table, the academical and research institutions are arranged according to their age. It shows the numbers of students and the results of examinations during the last 12 years. It will be seen that Halle and Göttingen are more popular amongst Germans other than Prussians and amongst foreigners than the other centres of education, and further, as appears natural from their geographical position, that Breslau and Königsberg also attract foreigners to a certain extent while the attendance of Germans other than Prussians is strikingly low. In order that the examination results should be comparative they should be expressed as percentages of the students during the periods under consideration but the material is insufficient to do this. From the statistics it appears also that the attendance at the Berlin college is by far the highest of all the academical institutions of Prussia both absolutely and relatively and the examination results testify to the diligence of the students.

The independent agricultural colleges are heavily handicapped compared with agricultural faculties of universities or technical college by not possessing the right to grant doctor's degrees, and, if the question it to be solved as to which form of academical education is most suitable and successful for agriculture, it would be necessary to place the independent agricultural colleges on an equal footing with the universities and technical and veterinary colleges such as the " Hochschule fur Bodenkultur " at Vienna, with regard to entrance examinations and to the standing of the final diploma or degree.

Table III gives a general account of the running expenses of the academical institutions for agricultural education and research for the year 1910, the latest year for which material is available. It shows that the faculty of agriculture at Kiel has still remained quite undeveloped, and that at Breslau salaries are a relatively important item compared to other universities owing to the budget being charged with a number of pensions.

The table further confirms the statement made above, that independent agricultural colleges require larger contributions from the State than agricultural faculties attached to larger scientific centres, because the former need a special staff and equipment for each auxiliary science which is unnecessary when the agricultural faculty is attached to a university or tecnical college.

It is impossible to judge of the value of the academical education from the statistical material contained in these tables as the figures refer only to minor points and fail to consider the most important point, *i. e.* the scientific activity. Productive and creative scientific work should form the basis of work at centres of academical education and provide the means of instruction, while didactic methods may be employed in all secondary and primary educational institutions.

For modern research work a considerable equipment is required. Libraries, laboratories and museums are no longer sufficient, but fields, gardens, accommodation for live stock, etc. are necessary in order to investigate the many questions which agricultural practice alone can never solve. In this respect the Berlin College, so richly endowed in other directions, is inferior to all the other academical centres of Germanyy with the exception of Kiel (see *table II* last column), and only now, after an existence of 32 years, is this lack of experimental equipment about to be remedied.

Table IV gives a summary of the attendance and expenses of the three higher horticultural institutions of Prussia. The lack of suitable experimental area at the Dahlem institution is striking, being probably due to the difficulty of obtaining suitable lands in the neighbourhood of Berlin.

Table V is a summary of the attendance and expenses of the secondary agricultural educational institutions: of the agricultural seminaries for the year 1911 (the second seminary being only founded in 1910) and of the agricultural schools for 1910. This table shows that at present the State contributes somewhat more than the sums of the independant incomes of these institutions and that, besides the State, the provincial and local authorities contribute to their maintainance.

The secondary agricultural educational institutions are everywhere provided with experimental fields but unfortunately, in a number of cases, the area is very insufficient. Greater facilities for object lessons would be very desirable.

Table VI is an summary of the attendance and expenses of farm and winter courses in Prussia in 1910. These show very different development in the various provinces. The best in this respect are the Rhine province, Hanover and Westphalia, then follow East Prussia, Schleswig-Holstein, Saxony, Brandenburg, Silesia and Posen; last of all come the district of Cassel, West Prussia and Pomerania, Wiesbaden and Hohenzollern being left out of consideration. The number of winter courses exceeds considerably that of the farm schools (212 against 17) and it would seem that the former are a form of agricultural education especially suitable for many localities.

The largest part of the expense of keeping up these schools is defrayed by the State, the next contribution in point of importance being provided

by their own income (school fees etc.), and smaller amounts by grants from the provincial and local unions, from local authorities and, lastly, from chambes of agriculture and agricultural associations, though the latter in a great majority of cases, were the original founders fo the schools.

Table VII gives data refering to the specialised primary schools in Prussia, among which the farrier's schools are by far the most numerous, while financially the dairy schools are the most important. Next to these come the gardening schools. Further details can be seen in the tables. The directors of the winter courses and, to a great extent also, those of the specialized lower schools act as travelling lecturers in their spare time for their own districts, and do a great deal of good by gaining the confidence of the inhabitants and thus increasing the attendance at their schools. There are besides a number of official travelling lecturers not attached to any school.

Table VIII gives data concerning the unattached travelling lecturers and instructors in Prussia in 1910; their numbers, their districts and their salaries, as well the sources of the same. In point of importance the State grants come first, followed by those of the chambers of agriculture and of the agricultural associations ; the latter oganisations in most cases also decide upon the work that is to be done. Provincial or local unions limit their grants to travelling lecturers for fruit growing, wine making and animal husbandry.

Table IX is a summary of the state, expenses and distribution of schools of domestic economy in Prussia in 1910 for girls who have already received the ordinary compulsory primary education. In this group of schools upwards of 77 per cent. of their expenses are defrayed by their own income, 9 per cent. by district federations and local authorities, 6.4 per cent. by State aid and the rest by chambers of agriculture, associations, provincial federations, etc. Silesia is at the head of the list with 12 of these permanent institutions followed by the Rhine province with 9, Westphalia with 8, and the other provinces. The greater number are travelling schools, especially in the Rhine province, Hanover and Silesia. Next in order come the continuation courses in domestic economy, which are specially prevalent in East Prussia. It is greatly to be desired that this form of education, which has given such excellent results and is in such a flourishing condition, should continue to develop.

Table X shows the development of agricultural courses and continuation classes in the years 1910-11 and affords satisfactory proof of the interest taken by farmers in this form of education. The contribution from the State and other sources for the courses dealing with general subjects is small in comparison to their own income, but on the other hand this order of things is reversed in the case of the special courses which are much more numerous. The former are mainly attended by farmers from the districts in which large farms prevail, the latter by small farmers.

Table XI sets out the total expenditure for all the above mentioned educational institutions dealing with agriculture and domestic economy in Prussia. It shows that, of the total cost 36.9 per cent. is defrayed by the

ndependent income of the institutions, 39.9 per cent. by the State, 8.8 per ent. by the provincial federations, 8 per cent. by local authorities 5.2 per ent. by the Chambers of Agriculture and agricultural associations and .2 per cent. by other sources.

The State contribution of 3 871 385 marks (£189 698) was distrib-ıted as follows:

1) 1 455 472 marks (£71 318) to the academical and research insti-utions, and 1 435 marks (£70) to the general agricultural courses, making ltogether 1 456 907 marks (£71 388) or 37.6 per cent. The part expended n education chiefly benefits the class of large landowners while the amount pent on research work and furtherance of agricultural science benefits very class of Prussian farmers.

2) 1 996 368 marks (£97 822) or 51.6 per cent. to the secondary and ower educational institutions, including 52 545 marks (£2 575) for special courses. Medium sized and small landowners and farmers are chiefly benefited by this contribution.

3) 329 963 marks (£16 169) or 8.5 per cent. to the higher horticul-tural schools.

4) 88 147 marks (£4 317) or 2.3 per cent. to education in domestic science.

Notwithstanding the fact that the greater part of the State contribution benefits the medium-sized and small farms, this outlay is very moderate for a State like Prussia and justifies the desire not only for increased grants but also for general progress in the whole system of agricultural education (1). Teaching by means of object lessons must be practised in every degree of agricultural education, from the lowest (which has not yet been univer-sally adopted in Prussia) up to the highest, and to a much greater extent than has been customary until now, for such lessons produce a much more lasting effect than mere words.

The great progress that agriculture has achieved in Germany during the last quarter of a century is the result of the union of practice with science, and proves that money spent on research and on education in every class brings in a high rate of interest and is compensated by the increase of returns, of land taxes and of the revenue from the State railways. The expenditure of money on education is not an outlay but an investment which is eventually returned to the State with an abundant surplus, as though it were placed in some profitable business undertaking. It is therefore not only justifiable but, from the point of view of modern economics, actually necessary, until the highest possible rate of production be reached in all classes of farms and in all parts of the country. Failing to do so signifies an incomplete utilization of existing possibilities of production and keeping down the national wealth.

(1) Cfr. "*Testtagung des Kgl. Preuss. Landes-Ock, Kollegium*, 1913" p. 80 et seg.

TABLE I. — *Institutions for agricultural education in Germany, taken*

	Academic Institutions far agricultural education and research						Secondary schools			
	Universities	High Schools	Academies	Technical Colleges	Research Institutes	Veterinary Schools	Seminaries	Schools	Horticultural High Schools	Estate
Prussia	5	1	1	—	1	2	2	18	3	
Bavaria	—	—	1	1	—	1	—	3	—	
Saxony	1	—	—	—	—	1	—	9	—	
Wurtemburg	—	1	—	—	—	—	—	—	—	
Baden	—	—	—	—	—	1	—	—	—	
Hesse	1	—	—	—	—	—	—	1	—	
Mecklemburgo	(1) 1	—	—	—	—	—	—	—	—	
Saxe-Weimar	1	—	—	—	—	—	—	—	—	
Oldenburg	—	—	—	—	—	—	—	1	—	
Brunswich	—	—	—	—	—	—	—	1	—	
Thuringia, Anhalt, Waldeck	—	—	—	—	—	—	—	1	—	
Free States	—	—	—	—	—	—	—	—	—	
Alsace-Loraine	—	—	—	—	—	—	—	1	—	
Germany, total	9	2	2	1	1	5	2	35	3	

(1) Only just started and still sonewhat imperfectly organised.

TABLE II. — *Attendance and examin*

	Date of foundation	Total no. of students up to end of 1911-12	Nationality of student		
			Prussians	Other Germans	
1. Halle University	1863	22 871	13 217	4 133	5
2. Goettingen »	1872	3 005	1 999	434	
3. Kiel »	1873	186	152	16	
4. Königsberg »	1876	2 059	1 659	62	
5. Breslau »	1881	3 167	2 535	91	
Total		31 288	19 562	4 736	6
Agr. Academy Bonn-Poppelsdorf	1847	6 889	5 411	860	
Agr. High School, Berlin	1881	31 148	24 266	3 411	3
"Kaiser Wilhelm" Institute, Bromberg	1906	27	27	—	
Total		38 064	29 704	4 271	4
Total no. of students in all Academic Institutions		69 352	49 266	9 007	11

el und v. Lengerke's Landwirtschaftl. Kalender 1914, *Teil* II ».

Elementary schools									Travelling lecturers	Schools of domestic economy	Rural continuation schools
Winter courses	Grass Land Management Schools	Dairy Schools	Gardening Schools	Farriery Schools	Poultry Farms	Bee-keeping Schools	Engineering Courses	Shepherding Courses			
212	6	16	14	71	7	3	—	—	5 349	212	179
45	1	1	7	4	—	—	1	1	213	18	17
1	—	—	3	—	—	—	1	—	—	2	—
8	—	1	4	5	—	—	—	—	—	2	—
16	1	—	—	4	—	—	—	—	—	5	—
9	—	—	2	—	—	—	—	—	—	3	—
4	—	1	—	—	—	—	—	—	—	—	—
2	—	—	1	—	—	—	—	—	—	1	—
11	—	—	—	—	—	—	—	—	—	—	—
1	—	—	—	—	—	—	—	—	—	1	—
10	—	—	1	—	—	—	—	—	3	4	—
2	—	—	—	—	—	—	—	—	—	—	—
13	1	—	3	3	—	—	—	—	—	5	—
334	9	19	35	87	7	3	2	1	5 565	253	196

in Academic Institutions.

% total students			Examinations passed 1899-1912									
	Other Germans	Foreigners	Degrees	Diplomas	Teacher's diplomas	Land surveying: with drainage and irrigation	Land surveying: without drainage and irrigation	Drainage and irrigation	Brewery science	Distillery science	Live stock Inspectorship
8	18.1	24.1	74	216	74	—	—	—	—	—	42
5	14.4	19.1	58	35	18	—	—	—	—	—	12
7	8.6	9.7	3	3	—	—	—	—	—	—	—
6	3.0	16.4	51	29	34	—	—	—	—	—	2
0	2.9	17.1	42	59	11	—	—	—	—	—	9
5	15.2	22.3	228	342	137	—	—	—	—	—	65
5	12.5	9.0	—	251	83	956	169	9	—	—	44
9	10.9	11.2	—	305	67	554	614	4	62	4	25
0	—	—	—	—	—	—	—	—	—	—	—
0	11.2	10.8	—	556	150	1 510	783	13	62	4	69
1	12.9	16.0									

TABLE III. — *Expenses of Academic Institutio*

	Salaries etc.	Running expenses	Up-keep of buildings and garden
	marks	marks	marks
Halle University	68 688	201 040	8 503
Gœttingen »	63 762	61 063	5 590
Kiel »	800	1 055	—
Königsberg »	61 235	111 747	9 505
Breslau »	74 096	75 075	1 462
Total . . .	268 581	449 980	25 060
Agr. Academy, Bonn-Poppelsdorf	183 770	198 955	20 946
Agr. High School, Berlin (1).	337 419	211 583	22 346
"Kaiser Wilhelm" Institute, Bromberg . . .	74 730	159 128	6 797
Total . . .	595 919	569 666	50 089
Total for all Academic Institutions . . .	864 500	1 019 646	75 149

(1) Embraces the study of all agricultural industries (distillery, brewery, etc.).
(2) A property at Wunde also serves as an experimental farm.
(3) Some fields at Dahlem belonging to the Brandeburg Chamber of Agriculture are u

TABLE IV. — *Attendance and expen*

Name and date of fundation		Total no. of students		Total expenses
		1910	Since the foundation	in 1910
				marks
Dahlem (1823)	full time students . .	110	1 088	152 515
Proskau (1868)		86	1 239	101 769
Geisenheim a. Rh. (1872).		81	1 538	227 200
	special research students.	42	528	Sa 481 484
	short course students . .	29	8 479	

Agricultural Research Stations in 1910.

velling penses	Other expenses	Government grant	Independent income	Total income		Area of experimental fields and garden
narks	marks	marks	marks	marks		ha.
500	1 500	195 201	85 030	280 231		116.83
628	92	100 773	30 363	131 136	(2)	11.20
—	1 680	3 535	—	3 535		—
1 200	—	139 947	43 740	183 687		137.76
600	—	123 716	27 517	151 233		32.58
2 928	3 272	563 172	186 650	749 822		298.37
9 624	18 404	193 792	237 907	431 699		147.70
6 008	33 984	452 851	158 489	611 340	(3)	—
0 835	20 460	245 567	26 293	271 950		85.00
6 467	72 848	892 300	422 689	1 314 989		232.70
9 395	76 120	1 455 472	609 339	2 064 811		531.07

xperimental fields.

Horticultural High Schools.

Receipts			No. of students having taken the diploma up to end of 1911	Area of experimental ground
ndependent income	Government grant	Other grants		
marks	marks	marks		ha.
34 995	113 330	4 190	106	—
15 300	86 469	—	44	54.78
97 036	130 164	—	12	33.03
147 331	329 963	4 190	162	87.81

TABLE V. — *Attendance and expenses*

	No. of pupils in 1911		No. of pupils who have obtained the diploma up to 1911-12	Teaching staff		Independent income —
	Total	Farmers' sons		Masters and directors	assistants	
						marks
Agricultural Seminaries (1911).						
Königsberg.	15	—	40	2	6	4 204
Schweidnitz	27	—	27	1	8	9 450
Total . . .	42	—	67	3	14	13 654
Agricultural Schools (1910).						
Heiligembeil	176	67	403	8	2	20 221
Marggrabowo.	127	41	286	11	3	22 904
Marienburg	256	106	810	11	4	35 752
Dahme	327	123	826	13	1	43 645
Schivelbein.	213	69	687	10	—	26 733
Eldena	182	77	504	9	3	22 560
Samter	199	48	586	8	1	25 841
Bojanowo	159	55	51	8	1	18 982
Brieg	250	98	709	8	6	28 835
Liegnitz	298	117	792	9	6	36 532
Salzwedel	257	69	33	10	—	29 629
Flensburg (1)	76	39	310	6	5	135 237
Hildesheim.	237	148	877	13	1	40 051
Lüdinghausen	204	75	863	12	1	36 926
Herford (2).	301	56	481	15	3	36 105
Weilburg.	99	28	396	8	2	18 362
Cleve	312	98	846	12	3	42 672
Bitburg	195	95	1 337	7	6	23 525
Total . . .	3 868	1 389	10 797	178	48	644 512
Total for seminaries . . .	—	—	—	—	—	13 654
					Total . . .	658 166

(1) Excluding preparatory classes. — (2) Including pupils of technical schools.

econdary agricultural schools.

Grants fron:				Total receipts	Total expenses	Area of experi-mental ground
State	provincial and local unions	local autorities	chambers of agriculture and agricultural societies			
arks	marks	marks	marks	marks	marks	ha.
—	500	—	500	5 204	5 204	—
0 000	—	—	2 750	22 200	22 700	—
0 000	500	—	3 250	27 404	27 404	—
0 950	—	1 090	—	62 171	82 062	0.3037
2 250	—	11 698	—	76 852	76 852	0.1763
4 020	4 500	4 450	—	98 722	102 012	0.04
9 350	—	160	—	83 155	85 120	0.3570
6 350	4 500	13 395	—	80 978	80 344	0.13
3 960	4 000	3 900	—	64 410	81 457	0.25
4 370	—	971	—	61 182	65 072	0.1225
6 300	1 000	5 175	500	61 957	61 980	0.5
0 055	2 400	—	1 590	62 790	62 790	2.0
0 075	7 500	—	3 750	77 857	77 857	0.5
1 000	—	20 857	—	71 486	71 486	0.5
3 115	—	70 155	2 000	240 507	240 507	0.16
5 950	—	1 304	—	87 305	91 805	0.64
4 200	9 500	5 212	200	85 038	85 267	2.6
7 750	8 000	27 265	—	109 120	106 120	1.0
3 550	2 900	8 259	—	73 071	73 071	0.7686
0 600	4 500	4 375	—	82 147	82 147	1.5
1 300	4 500	2 400	—	61 725	64 133	1.5
5 135	53 300	179 576	7 950	1 540 473	1 590 082	13.0481
0 000	500	—	3 250	27 404	27 404	—
5 135	53 800	179 576	11 200	1 567 877	1 617 486	13.0481

TABLE VI. — *Attendance and expenses of elementa*

	Total no. of schools and courses 1911-12	No. of pupils 1911-12	Average per school	Total no. of pupils in school up to March 1912	No. who took full course	pro-vincia and local union
East Prusia	19	690	36	8 437	3 808	—
West Prusia	9	377	42	3 595	1 866	—
Brandenburg	13 (4)	524	40	5 787	2 757	—
Pomerania	7 (1)	325	46	3 448	1 263	—
Posen	13	427	33	3 629	1 482	—
Silesia	13 (1)	798	61	15 228	6 535	—
Saxony	13 (1)	779	60	16 574	9 119	—
Schleswig-Holstein	14 (2)	940	67	11 320	5 450	—
Hanover	42 (5)	2 268	54	37 288	13 788	(1
Westphalia	23 (1)	1 475	64	21 755	8 285	—
District of Cassel	10	404	40	5 035	1 966	—
District of Wiesbaden	4	130	32	1 700	543	—
Rhine province	47 (1)	1 336	28	20 541	7 602	1
Hohenzollern	2 (1)	55	27	747	644	2 (1
Total	229 (17)	10 528	46	155 084	65 108	3 (2

(1) Figures in brackets refer to schools.

TABLE VII. — *Attendance and expen*

	No. of schools	Total no. of pupils		Total expenses
		1910	up to end of 1911-12	in 1910
				marks
Dairy Schools	15	393	7 191	424 267
Gardening Schools	14	318	3 788	357 783
Farriery Schools	70	1 105	21 143	132 163
Grass Management Schools	5	581	4 157	108 596
Poultry Farms	7	188	1 160	86 085
Beekeeping Schools	3	91	1 319	6 580
Total	114	2 076	38 758	1 116 383

icultural institutions. (Schools and winter courses).

ools founded by: local utorities				Expenses					
					paid by:				
"Kreise"	"Gemeinden"	chamber of agr. and agr. societies	private entreprise	Total	independent income	the State	provincial and local unions	local authorities	chambers of agr. and agr. societeties
				marks	marks	marks	marks	marks	marks
—	—	19	—	155 312	20 739	84 700	28 415	15 046	7 407
—	—	9	—	96 382	10 677	67 098	9 236	11 260	500
—	1	12 (4)	—	178 158	50 677	52 750	48 017	21 809	16 777
—	—	7 (1)	—	107 183	23 922	36 281	18 600	7 800	20 580
—	—	7	6	121 095	15 274	77 298	17 195	10 450	2 297
—	—	12	(1)	146 363	34 967	46 360	38 710	13 850	17 276
—	—	12	(1)	169 358	81 585	12 754	64 158	11 731	600
	(2)	—	—	159 063	55 933	34 218	27 000	39 832	2 080
(1)	3 (2)	2 (1)	1	372 745	131 786	53 042	75 518	99 304	9 080
	2	—	5 (1)	229 204	57 470	35 590	37 538	28 565	3 863
—	—	10	—	86 866	12 456	30 550	19 500	23 000	1 360
—	1	3	—	17 938	2 120	9 000	3 600	4 543	1 500
—	2 (1)	44	—	288 815	34 798	70 720	114 200	60 950	8 147
—	—	—	—	10 148	388	—	9 750	—	60
(1)	9 (5)	137 (6)	12 (3)	2 138 730	532 832	610 361	511 437	402 140	91 527

special elementary schools.

	Expenses defrayed by:				
	grants from:				
independant income	the State	the province	local authorities	chambers of agr. and agr. societies	founders etc.
marks	marks	marks	marks	marks	marks
255 303	101 383	35 983	100	26 674	6 723
132 922	41 378	135 185	7 488	23 990	16 600
54 708	22 376	7 690	38 856	8 111	—
40 943	25 554	29 855	7 783	1 200	3 261
44 676	33 672	—	—	8 637	—
1 958	1 650	1 500	—	350	1 369
530 530	226 013	210 213	54 227	68 962	27 953

TABLE VIII. — *Number and expenses*

Subjects	No. of lecturers	Salaries and travelling expenses
		marks
a) General.	26	81 915
b) Practical agriculture	1	1 641
c) Seed selection.	9	20 508
d) Peat bog cultivation	1	7 465
e) Flax culture.	1	2 724
f) Management of pastures	1	4 536
g) Fruit growing and market gardening	42	169 454
h) Viticulture and market gardening.	2	9 790
i) Viticulture	4	17 381
k) Live stock	42	235 578
l) Pig breeding	4	21 502
m) Dairying	12	62 550
n) Horse breeding	6	43 367
o) Farriery	4	9 835
p) Poultry keeping.	10	44 281
q) Pisciculture	1	7 062
r) Cooperative live stock	3	11 828
s) Cooperative societies.	4	31 628
t) Book keeping	3	7 668
u) National economy	3	1 598
Total . . .	179	792 311

of official travelling lecturers.

Expenses defrayed by				
the State	provincial and local unions	local authorities	chambers of agriculture and agricultural societies	other sources
marks	marks	marks	marks	marks
49 322	—	—	32 593	—
1 359	—	—	282	—
10 073	—	—	10 435	—
7 068	—	—	397	—
2 618	—	—	106	—
3 000	—	—	1 536	—
95 480	15 950	6 499	46 841	4 684
2 650	1 200	—	5 940	—
9 625	7 756	—	—	—
141 231	16 150	—	77 597	600
10 000	—	—	11 502	—
23 694	—	—	24 620	14 236
24 000	—	96	19 271	—
6 660	—	—	3 175	—
29 401	—	—	14 880	—
750	750	—	5 562	—
10 341	—	—	1 487	—
11 142	—	—	13 514	6 972
3 900	—	—	3 768	—
—	—	—	1 598	—
442 314	41 806	6 595	275 104	26 492

TABLEAU IX. — *Schools of domest*

Province	Total no. of schools	Kind of school				Total expenses —
		Schools for general domestic science	Scools for agr. domestic science	Travelling schools	Continuation courses	
						marks
East Prussia	64	—	1	—	63	65 588
West Prussia	2	1	1	—	—	71 666
Brandeburg	2	—	1	1	—	20 476
Pomerania	8	—	1	7	—	23 284
Posen.	7	1	3	3	—	82 072
Silesia.	21	—	12	9	—	183 764
Saxony	12	1	5	4	2	188 947
Schlesvig-Holstein	3	—	3	—	—	55 685
Hanover	14	—	3	11	—	131 216
Wesphalia.	15	—	8	6	1	146 913
District of Cassel	8	1	—	7	—	70 510
» » Wiesbaden	11	—	3	8	—	61 792
Rhine province	51	—	9	33	—	261 761
Hohenzollern	3	—	2	1	—	13 529
Prussia . . .	221	4	52	90	66	1 377 203
	—	—	—	—	—	—

omy, expences and receipts in 1910.

dependent incomes	Expenses defrayed by grants from the State	provlnces	local authorities "Kreise"	local authorities "Gemeinden"	women's societies	chambers of agr. and agr. societies	other sources
marks	marks	marks	marks	marks	marks	marks	marks
44 001	14 050	5 000	1 787	500	—	250	—
60 151	4 830	—	—	—	2 685	—	—
11 110	900	2 500	800	700	—	4 434	32
16 755	750	150	2 319	400	—	2 705	205
60 144	18 386	2 000	300	300	327	500	115
154 871	8 876	—	3 417	610	660	8 209	3 121
179 000	4 000	—	2 500	—	1 638	1 548	261
42 053	5 800	—	200	—	200	7 239	193
109 045	4 800	2 400	5 054	750	1 190	2 053	5 914
104 146	250	4 250	25 014	3 420	612	1 675	7 546
59 540	5 455	—	3 083	805	1 503	—	124
39 935	2 500	300	6 821	1 864	200	1 800	8 372
172 878	11 900	5 700	53 566	6 934	757	2 400	7 626
8 934	1 650	430	430	—	—	—	2 085
1 066 563	88 147	22 730	105 291	16 283	9 772	32 813	35 604
77.4%	6.4%	1.7%	8.8%		0.7%	2.4%	2.6%

TABLE X. — *Agricultural c*

Courses	Year	No. of courses organised	Attendance	Elemen schoolm attend cours
1. General agricultural courses for practical farmers	1909	33	4 436	—
	1910	37	5 316	—
	1911	30	3 912	—
2. Special courses	1909	1 128	23 925	8
	1910	1 153	25 708	9
	1911	1 324	32 029	8
Total for each year	1909	1 161	28 361	8
	1910	1 190	31 024	9
	1911	1 354	35 941	8
Total for three years	—	3 705	95 326	2 6

TABLE XI. — *Total cost*

	No. of institutions	Independent income	the Stat
		marks	marks
Academic education	8	609 339	1 455 4
Horticultural high schools	3	147 431	329 9
Secondary schools	20	658 166	665 1
Farm schools and winter courses	229	532 832	610 3
Primary education	114	530 330	226 0
Travelling lecturers	179	—	442 3
Schools of domestic economy	212	1 066 563	88 1
Special agricultural courses	1 190	33 462	53 9
Total	—	3 578 223	3 871 3
Per cent	—	36.9 %	39.9

continuation classes 1909-1911.

Total expenses	Expenses defrayed by:						
	fees	grant from:					
		the State	provincial and local unions	local autorities	chambers of agr. and agr. societies	other associations
marks	marks	marks	marks	marks	marks	marks
16 107	13 294	559	—	—	2 084	170
18 692	11 051	1 435	750	—	3 656	1 800
15 692	11 606	772	—	—	3 094	220
131 050	22 538	54 616	9 787	10 508	17 314	16 287
123 071	22 411	52 545	8 654	7 694	17 412	14 355
119 702	20 130	51 068	9 824	9 169	13 408	16 103
147 157	35 832	55 175	9 787	10 508	19 398	16 457
141 763	33 462	53 980	9 404	7 694	21 068	16 155
135 394	31 736	51 840	9 824	9 169	16 502	16 323
424 314	101 030	160 995	29 015	27 371	56 968	48 935

icultural education in 1910.

Grants from:				Total receipts
rovincial unions	local unions	chambers of agr. and agr. societies	others	
marks	marks	marks	marks	marks
—	—	—	—	2 064 811
—	—	—	4 190	481 484
53 800	179 576	11 200	—	1 567 877
511 437	402 140	91 527	—	2 148 297
210 213	54 227	68 962	27 953	1 117 898
41 806	6 595	275 104	26 492	792 311
22 730	121 574	32 813	45 376	1 377 203
9 404	7 694	21 068	16 155	141 763
849 390	771 806	500 674	120 166	9,691 644
8.8 %	8.0 %	5.2 %	1.2 %	—

The Cattle Industry in Italy at the Present Day

by

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THE 1908 CENSUS AND RELATIVE DENSITY OF CATTLE IN THE VARIOUS REGIONS OF ITALY.

In all live stock censuses taken previous to March 19, 1908, the data was supplied by the owners of the animals themselves who filled in special forms ; but in the 1908 census, the data was collected by census officials, this system having been rendered possible by the improvements in the technical and administrative services of the local and provincial governments. Its results are therefore much more reliable than preceding ones. They show that in the whole country there existed altogether 6 192 861 head of cattle distributed as follows :

1 390 550	calves under 1 year of age	22.4 per cent
128 583	bulls over 1 year of age	2.1 »
3 403 377	heifers and cows over 1 year of age . .	54.9 »
1 276 346	oxen and steers over 1 year of age . .	20.5 »

In comparison with the numbers of the preceding census (1881) the increase returned was 1 426 699 head, that is, in 27 years the number of cattle increased by one third of the number existing in February 1881. The variation in each class and in the distribution of the total herd being as follows : (Tables I and II).

TABLE I.

Year	Calves	Bulls	Cows and heifers	Oxen and steers	Total
1881.	957 307	45 092	2 366 556	1 403 207	4 772 162
1908.	1 390 555	128 583	3 403 377	1 276 346	6 198 861
Difference . .	+ 433 288	+ 83 491	1 036 821	— 126 861	1 426 699

Arranging the 16 regions of Italy according to the number of cattle per unit area, they appear in the following order :

1. Emilia. — 2. Lombardy. — 3. Venetia. — 4. Piedmont. — 5. Marches — 6. Liguria. — 7. Tuscany — 8. Sardinia. — 9. Campania. — 10. Umbria. — 11. Latium. — 12. Calabria. — 13. Abruzzi and Molise. — 14. Sicily. — 15. Basilicata. — 16. Apulia.

With the exception of Liguria, the provinces of Northern Italy show the highest figures for density of cattle. Next come Central Italy together whit Sardinia and Campania, and last of all the Southern Provinces and Sicily.

TABLE II. — *Distribution of cattle.*

	No. existing on March 19, 1908			Increase over the census of 1881			
	per sq. mile		per 100 habitants (census 1-1-1908)	Absolute increase	per sq. mile		Per 100 animals returned in 1881
	of the geographical area	of the crops and permanent pasture area			of the geographical area	of the crops and permanent pasture area	
Piedmont	84.66	133.33	27.9	118 947	10.43	16.31	14.06
Lombardy	116.76	171.91	23.9	254 006	21.77	40.13	29.13
Venetia	97.61	132.82	27.1	190 058	19.50	27.18	25.04
Liguria	47.16	124.53	8.4	12 544	6.14	15.79	14.63
Emilia	120.13	159.48	38.1	302 188	34.80	49.97	45.90
Marches	68.35	83.11	23.8	63 703	17.01	20.45	33.10
Umbria	35.21	50.49	19.1	33 239	8.83	12.69	33.62
Tuscany	42.46	70.42	14.8	46 317	5.41	9.06	14.95
Latium	28.22	39.09	10.1	37 227	7.97	11.13	39.48
Abruzzi and Molise	22.52	30.55	9.9	43 482	6.78	9.06	43.07
Apulia	12.95	17.86	4.6	Diminished			
Campania	35.73	49.71	7.0	84 581	13.46	18.64	60.09
Basilicata	16.83	23.56	13.9	24 175	6.27	8.54	58.90
Calabria	24.85	39.87	10.2	59 335	10.17	16.31	69.00
Sicily	19.94	25.37	5.5	73 079	7.33	9.32	58.28
Sardinia	40.25	45.57	44.4	98 303	10.54	11.91	35.18
The whole Kingdom	55.92	61.62	18.3	1 426 699	12.87	13.98	28.90

IMPROVEMENT IN THE QUALITY OF THE CATTLE AND BRIEF SURVEY OF THE PRINCIPAL BREEDS AND VARIETIES.

The Italian breeds and varieties have undergone variations of late in their anatomical and physiological characters owing to improved environmental conditions, especially of feeding, and to progress in the methods of breeding and rearing. Some breeds have improved considerably with regard to their live weight, early maturity and milk yield, especially those belonging to regions where agriculture and animal husbandry are best developed. It is only during the last few years that series of observations en the morphological and physiological characters of the live stock have been made here and there, and there is as yet no complete and systematic description of the Italian breeds and varieties. Thus direct and precise chronological comparisons cannot be made. But the progress already achieved can be gauged by a number of facts intimately connected with the country's production and consequently with the productiveness of the animals.

Owing to her great variety of climate, soil and agricultural conditions,

Italy possesses many different breeds and varieties of cattle; almost every region has its own, and in some of them the varieties are numerous, as in the various belts of mountains which form the Alps and the Apennines. But not all of them have the same importance nor have they all undergone the same progressive evolution with the renewed agricultural and economic activity of the country. Among the number, some deserve to be especially mentioned as they possess qualities in virtue of which they may well compete with foreign breeds.

A. *Piedmont.* — Among the several Piedmontese breeds the prevailing and characteristic breed is the cattle of the *Piedmontese Plain* which varies somewhat from one part to another according to local conditions. It is divided into *Improved Plain breed* and *Common Plain breed*. The best specimens of the former, called also the *Carmagnola* breed, are found in the districts of Carmagnola, Savigliano, Bra, Racconigi and Chieri. The animals are high standing, light dun, or often white, with black points. They are good workers and beef producers and fair milkers. They are not coarse and, being rather early maturing, they fatten easily on suitable food and yield highly esteemed flesh. At the age of 18 to 20 months they weigh upwards of 1320 lbs. At the age of four years they weigh upwards of 2200 lbs and fat oxen, though not highly finished reach from 2420 to 2640 lbs and more. The second division of the breed which is found in the valleys and on the hills south of the Po, along the course of the Stura, the Tanaro and the Scrivia, and in several parts of the province of Cuneo, differs from the preceding breed by its greater hardiness, its smaller stature and by its red coat. It is a better working animal but a poor milker and only fairly suitable for fattening. This latter quality is however more developed in certain improved strains such as the cattle of the Langhe hills.

In the mountainous parts of Piedmont, the cattle is very varied and consists of numerous ill-defined breeds and varieties:

The cattle of the Stura valley belongs to the *Demonte* breed, so called from its principal centre of production. It resembles the *Piedmontese Plain* breed and, according to some observers, also the *Alpine* type. It is a good working animal and a fair milker.

The *Valdostana* breed inhabits the valley of Aosta and the numerous neighbouring valleys. It is small is stature, rarely over 4 ft. high, while some cows just reach 3 ft. 3 in. Its coat varies very much, being red, or dark chestnut, or spotted red, or spotted black. Breeders prefer dark red, chestnut and spotted red. The great variety in the colours is attributed to the large number of out crosses constantly occurring. It is chiefly suitable for the production of milk, from which butter and the cheese called "fontina" are made. *Valdostan* cows yield on average about 1.32 gallons of milk per day, or 330 gallons in 8 months, some attaining 440 and even 528 gallons. The cattle are kept in the valleys during the winter and from June to September on the Alps up to a height of 8000 feet.

In the valleys of the district of Pinerolo the prevailing breed is called *Tarantaise* or *Tarina* after its place of origin (Tarantasia in the upper Isère valley) or, more commonly, *Savoyard*. SANSON includes it among the

varieties of the *Alpine* breed. The average weight of the bulls and oxen is between 1320 and 1540 lbs and of the cows 880 to 1100 lbs. The stature of the adult animals is about 5 ft. 4 in. The coat is dun, darker in the males, with black points. They are good strong working animals being at the same time fair producers of meat, while the cows are good milkers and yield 440 to 550 gallons of milk per annum. The lactation period lasts about seven months, the quantity of milk being relatively uniform and diminishing but slightly.

On the mountains in the neighbourhood of Biella there is a breed of small spotted cattle not without merit for its build and yield of milk. It is known as the *Oropa* breed, and the area it occupies is rather limited.

Besides the local breeds of cattle, which are the prevailing ones in Piedmont, there are also foreign breeds such as the *Schwyz* cattle, especially in the irrigated parts of the provinces of Novara and Vercelli, where the characteristic farming of the lower Po valley begins. *Dutch* cattle are also met with here and there, but not so frequently, though there are some herds of a certain importance, suchas for instance the herd belonging toc omm. VIGNOLA at Marozzo in the Mondovì district. These two breeds are kept pure, and also crossed, the crosses being much esteemed for their milking qualities.

B. *Lombardy*. — Both in Upper and Lower Lombardy, and more especially in the latter, cattle are kept chiefly for the production of milk, hence the great prevalence of the breeds and varieties which are heavy milkers.

In the rich plain that includes the Lomellina district, the neighbourhood of Pavia, the lower Milanese territory and the province of Cremona the brown *Schwyz* breed is the most prevalent.

For the most part these animals are imported directly,from Switzerland or from the Italian pre-alpine districts for the immediate and exclusive production of milk. There is thus no local breed nor is breeding and rearing of young animals generally practised. Very nearly the same may be said of those other districts presenting similar agricultural conditions, such as the lower part of the provinces of Bergamo and Brescia and a good portion of the province of Mantua, as well as some belts of land on the right bank of the Po.

The Alpine region is stocked with cattle belonging to one type, but varying in appearance and characters from one locality to another according to local and climatic conditions. SANSON groups all local varieties under the comprehensive denomination of *Alpine* breed. Considering the favourable natural conditions of this region it ought to be capable of stocking the byres of Lombardy and other lowland regions, a branch of indu try hitherto left to Switzerland. Of late years the general improvement in the animal husbandry of the country has also been spreading in this region, and already considerable progress is noticeable: some valleys of the provinces of Sondrio, Bergamo and Brescia are already in a position to supply dairy cattle, and several provinces of the kindgom have recourse to them for restocking their cattle sheds and byres. These results are largely due to the spread of associations for the promotion of agriculture and animal husbandry, to the

institution of herd-books, to cooperative dairies, to associations for the alpine grazing of young animals etc.

Working oxen are also an important item amongst cattle in Lombardy, and are represented by several breeds. In the territory bordering on Piedmont the cattle of the *Piedmontese Plain* prevail, partly imported directly and partly bred in the locality itself. In the provinces of Brescia, Cremona, Bergamo the so-called *Tyrolese* breed is largely represented, derived either directly from the Tyrolean cattle or from its more local representatives, the best types of which are the *Meran* and the *Ulten Valley* breeds; these animals are highly esteemed both as working and beef animals, as they fatten well and give a good carcase weight. A certain contingent is also supplied by cattle of *Podolian* breeds and by several crosses.

C. *Venetia.*— The lack of definite varieties which characterizes the cattle of almost all the Alpine regions is more marked in the large mountainous district which constitutes the greater portion of Venetia than anywhere else. In this mixture of types however a common relationship to the *Alpine* type can be traced. They are small animals destined exclusively to the production of milk for which they are fairly suitable. A certain amount of selection is observed in their breeding and good results have been obtained by crossing the cows with *Schwyz* and *Tyrolese* bulls. Breeding and rearing are in the hands of small breeders who up to recent years were very poor. Hence the deplorable condition into which live stock raising had fallen in that part of the country. But the establishment of cooperative dairies, which actually originated in this part of the country has marked the beginning of a new era. The first cooperative dairy began operations at Forno di Canale, near Agordo, on January 8, 1872. Since then cooperation has rapidly increased and perfected itself, and is proving most beneficial to the improvement of the cattle of the district.

In the rest Venetia working cattle prevail, and these are also used for the production of meat with more or less success according to the breed and general management. In the provinces of Rovigo and Padua the *Podolian* breed, commonly known as *Apulian* or *Paduan* is the most frequently met with. It is also found to a lesser extent in other provinces of the same region. Its characters are common to the cattle of Ferrara and Bologna districts and of Southern Italy. It is chiefly a working animal, being hardy and resistant, a very poor milker and fattens only to a limited extent. To the north of the province of Padua the most diffused breed is the *Tyrolese*, in which hardiness is blended with a certain degree of fineness so that it supplies animals suitable for draught purposes and at the same time producers of meat and milk, In the same province a certain number of *Simmentals* have lately been introduced. There are also a few *Schwyz* and *Rendena Valley* cattle.

But the greatest progress in animal husbandry has been made of late in Lower Friuli, where the local cattle has been radically transformed by crossing with *Simmentals*, so much so that the old dun *Friuli* breed as well as the *Jurassic* type have been almost completely replaced by the new cattle, known in the market as *Simmental-Friuli*. The names of two of

the principal men connected with this improvement are Dr. GABRIELE LUIGI PECILE (senator) and Dr. G. B. ROMANO (vet. surgeon). The same transformation has been carried out in Friuli as in the Grand-duchy of Baden and it is an unique example in the development of animal husbandry in Italy of what can be achieved whit suitable means and perseverance. The first attempts were made in 1870 ; the local government of the Province of Udine began by importing bulls from Meran and from Switzerland whih were immediately sold by auction ; the third year only *Friburg* bulls and heifers were imported. Sufficient funds having been voted in the budget, the yearly imports of breeding cattle has been continued, but after the first few years these have consisted entirely of *Simmentals*.

D. *Liguria*. — The cattle of Liguria is unimportant and is composed of types belonging to the neighbouring provinces. Besides a certain number of milch cows of various origins, but chiefly of the *Alpine* type, for the supply of milk to the centres of population, there are also *Piedmontese*, *Podolian* and *Pontremolese* cattle and various crosses.

E. *Emilia*. — Emilia is one of the regions in which great progress has been made in animal husbandry during the last thirty years. Its cattle is chiefly composed of native breeds, some of which are deservedly held in high esteem both at home and abroad. In some provinces there are also more or less numerous herds of foreign breeds especially in the mik producing belts. The *Schwyz* breed is widely spread especially in the irrigated parts of the provinces of Piacenza, Parma, Reggio, Modena and, to a lesser extent, in the other provinces. It is bred pure and also crossed with the local breeds. In these provinces *Dutch* cattle is also represented, but to a much more limited extent. The province of Piacenza has the greatest number of both breeds. In the province of Reggio, *Simmentals*, which have much affinity with the local breed, are becoming increasingly popular ; for several years they have been imported in considerable numbers both for pure herds and for crossing, with good results in both cases. *Durhams* and *Charolais* were imported several times into the provinces of Piacenza, Modena and Ferrara, but they were not successful and had no influence on the general trend of production. In this region the native local breeds are the most important, the chief of which are as follows :

a) The *Reggio-Parma* breed (or the *Dun-red Reggio* as it is called by the local breeders) is the prevailing breed in the plains and on the slopes of the Appennines in the two provinces of Reggio and Parma and spreads also into the province of Piacenza where it was once in great demand. It is considered a pure breed because its coat colour, which is its principal characteristic, is fairly constant. According to prevailing opinion it owes its origin to SANSON'S three breeds : *Jura*, *Alpine* and *Iberian ;* in fact it presents the characters of the three types in various combinations with a prevalence sometimes of one and sometimes of another, and lacks that uniformity which is the chief characteristic of pure breeds. The coat is sorrel and was formerly reddish, but with the improvement of the breed it has gradually grown paler. The principal external characters are a

very uniformly coloured coat which is extended to the brush of the tail, a depigmentation of the horns and hoofs and a flesh coloured muzzle. Brownish spots, streaks and shadings are considered signs of bastardy, and formerly depreciated the animals especially for breeding purposes. Now breeders are less strict upon this point and consider productivity more important. The stature, coat, shape, live weight and general performance of this breed of cattle are very variable. The Reggio strain is distinguished from that of Parma by a greater uniformity especially in the coat, due to the careful and persevering selection that these breeders have always practised and which some continue to practise with extreme care. A confirmation of this is afforded by the fact that the Parma breeders usually purchase their bulls from those of Reggio. This breed of cattle, which combines the qualities of working animals with those of meat and milk production, are specially noted for their milking qualities which form the basis of the flourishing local dairy industry.

The breed has been considerably improved during the last thirty years, especially with regard to increased milking capacity, the improvement being assisted by the great development of forage crops, notably lucerne, in that region. The striking increase in the number of dairies and the growth of the manufacture of the famous " grana " cheese of Reggio (known as Parmesan) cannot be solely attributed to the increased number of milch cows belonging to other breeds, as the numbers imported have not been relatively large. In this connection it should be noted that in the districts where cheese making is most developed, as in the plains of Reggio and Parma and in their continuation in the provinces of Piacenza and Modena, there is a very marked decrese in the number of oxen and steers and a considerable increase in that of cows and heifers, of bulls and of calves under one year of age. This has become possible owing to the smaller demand for working animals due to the larger acreage in forage crops. The cattle have also been improved with regard to meat production.

b) The so called *Bardigiana* or *Bardi* breed, perhaps more properly called *Valtarese* or *Taro Valley* breed, is a variety of the mountain breed which stocks the mountains of Piacenza and of Parma and which spreads also to the Pontremoli and Genoese districts. The principal centre of this breed is in the upper Taro valley from whence it spreads into Lunigiana and the Bardi Valley. The calves are sent to the latter districts immediately after weaning and kept there till four years old when they are bought by the farmers of the plains who use them for draught purposes. The breed is of small stature. The males stand 4 ft. 4 in. high, the females 4 ft. but they are compact and fairly well shaped. The fore quarters, as in the *Podolian* type, are more developed than the hind ones, the limbs are short with very hard hoofs which allow the unshod oxen to stand long journeys on the mountain roads. The coat is red in the main with darker patches and black points; owing to their hardiness they are excellent workers. They are not exacting, will adapt themselves to any kind of conditions, and, having a powerful digestion, usually present a thriving appearance with a certain

disposition to fatten. On being transferred to the plains, they respond to the higher feeding, increase in size, fatten easily and yield excellent meat.

c) Another variety of mountain cattle, much resembling the above in its anatomical and physiological charecters, is known under the name of the *Langhirano* breed. It differs from the *Taro Valley* breed only in having a greyish coat with darker patches, and like it resembles the *Podolian* type. It is found in the upper part of the valleys of the Enza, Parma and Baganza and is rather frequent on the Emilian Appennines. The oxen are robust and powerful draught animals and are much used for farm work both in the hills and plains.

d) The *Modenese* breed stocks the plain of the province of Modena and a small part of the neighbouring province of Reggio. It is also called *Carpigiana* because Carpi is its centre of production. Strictly speaking it is not a pure breed but is derived from both the *Jurassic* and *Alpine* types and exhibits even now a somewhat ill-defined mixture of both types. The prevailing colour is dun not infrequently milky white and often more or less gray. The Modenese breeders attach much importance to the pigmentation of certain parts of the body *i. e.* the tips of the horns, brush of the tail, eyelashes and hoofs should always be black, while the muzzle should present the so-called split or " grugn sciarpé " appearance, that is to say the whole muzzle is blackish with a red line down the centre. This breed of cattle produces both milk and meat and is also used for draught purposes. It is not such a good milker as the *Reggio Parma* breed, but some cows yield up to 3.3 gallons per day during the early part of the lactation. Of late years dairying has much increased in the plains of Modena and especially in that part bordering on the province of Reggio where conditions are somewhat resemble those of Reggio.

e) The cattle stocking the the rest of Emilia, that is the provinces of old Romagna, namely Bologna, Ferrara, Ravenna and Forlì, are for the most part derived from the *Podolian* breed, evidences of their common origin being very apparent in the various breeds. Three breeds are commonly recognised: the *Bolognese*, the *Ferrarese* and the *Romagnola* proper. The third is the most interesting on account of the great improvement it has undergone. Recently the other two also have been improved, especially the Bolognese, but to a lesser extent. The latter varies according as its habitat is in the plains or in the mountains. The plains cattle has a gray coat, sometimes light and almost white; it stands high and has a certain degree of fineness. The mountain cattle is of a darker gray with patches of a deeper colour still. They are smaller and more compact, very strong and hardy and possess very hard hoofs. Both are decidedly suitable as working animals, more especially the mountain cattle, while the plains cattle, on the other hand, produce fair meat. The breeders in the plain of Bologna, especially in the Imola district, are gradually adopting the methods which have been so successful in the adjoining province of Forlì.

The improved *Romagnola* breed (" gentile Romagnola ") dates its improvement from about twenty years ago, and is now so changed that *Podolian* characteristics have almost disappeared. It is found

in the plains of the two provinces of Forlì and Ravenna and spreads over the borders of the adjoining province of Bologna. The cattle of the moutainous belt is of the same type, but differs from it by its greater hardiness and by being chiefly a working animal. The improved cattle are large, high standing animals ; the calves, as in all the breeds descended from the *Podolian* type, have, up to the age of about three months, a reddish coat which then turns to a lightish gray, with a tendency to white ; the bulls are darker gray and with age patches of deeper colour appear, whilst cows and oxen remain a more uniformly dirty white. Both sexes have black points. The horns are not much developed, lyre shaped and black tipped. The whole body is harmoniously proportioned with the exception that the fore quarters are more developed than the hind ones, this being one of the characteristics of the *Podolian* type. Muscles masses are rather abundant. This breed of cattle combine more especially the qualities of working animals and butcher's beasts. Without possessing their primitive hardiness they are nevertheless sufficiently strong and robust to satisfy the demands of farm work and at the same time they possess that early maturity and fineness which are essential requisites in bucher's animals. The yield of milk is very small, barely sufficient for nourishing their own calves. Early maturity and a marked suitability for fattening are characteristic of the new breed.

At the age of four years, or shortlyafter, the incisors are all permanent, usually earlier in bulls than in the cows or oxen. The live weight of the calves at birth varies from 88 to 110 lbs. When adult, cows weigh on an average 1320 lbs, oxen 1540 lbs and bulls and fat oxen 2200 lbs and over. In the lot exhibited by the Torlonia Estate of Torre S. Mauro, Romagna at the Milan Exhibition in 1906 there were young bulls which at the age of 10 or 11 months weighed fro 880 to 990 lbs; four year-old bulls which weighed nearly 2400 lbs; one year-old heifers about 880 lbs, two year-old 1320 lbs and three year-old 1430 lbs ; cows from 5 to 6 years of age 1540 to 1760 lbs; oxen between 2 and 2 ½ years of age weighed from 1170 to 1670 lbs and those between 5 and 6 years 2110 to 2220 lbs (1). All *Romagnola* cattle is not improved to the same extent. The greatest degree of progress has been achieved in the principal centres of production, *i. e.* in the neighbourhood of Cesena and Rimini. The fame acquired by the breed during recent years is principally due to the enterprising spirit and perseverance of Loepoldo Tosi.

(*To be continued*)

(1) Ing. L. Tosi and Dr. G. Sbrozzi. — *La razza bovina romagnola dell'azienda Torre S. Mauro (Fattoria Torlonia)*. — Padova 1906.

Present State of Cattle Breeding in Uruguay

by

TEODORO and JUAN ANGEL ALVAREZ

Historical. — Up to the end of the sixteenth century there were no domestic animals in Uruguay. The natives lived exclusively by hunting, fishing and utilising the natural products of the soil. The first Spanish colonies founded along the banks of the Uruguay had only a brief existence. In 1603 the Governor HERNANDARIA DE SAAVEDRA caused a hundred head of cattle to be imported from Argentine together with two droves of mares and placed them in a locality provided with good pastures and plenty of water, where, together with other animals subsequently imported, they were allowed full liberty and multiplied to an extraordinary extent. In adapting themselves to their new kind of life and environment they modified the characters of the original Spanish cattle which the conquerors had introduced into the new continent and formed the local or "criolla" breed.

In 1624 the nucleus of San Domingo de Soriana was founded on the coast of Uruguay it soon attracted a current of immigration from Buenos Aires for the purpose of hunting the wild cattle and the trade in their hides. The beef had no market value while the skins fethed 0.80 pesos (3*s* 4*d*) each and were sent to Buenos Aires or to Spain. In 1680 another settlement was founded, La Colonia, and the trade in hides increased. This state of things continued until the invasion of the Portuguese in 1723 when Montevideo was founded. Among the privileges granted to the settlers the following were included: a plot of land of 25 × 50 "varas" (70 × 140 feet) upon which to huild a house, a field of 10 "cuadras" (18.22 acres) and a ranch of 1 "smerte de campo" equal to 4940 acres, besides which, each "estanciero" was given 200 head of cattle and 100 sheep. As the law did not prohibit the accumulation of land, which could be bought very cheaply, some enormous estates were formed, and even now there are some estates which include 10 "smertes de campo", (49 400 acres) entirely devoted to the breeding and fattening of cattle. In 1670 a decree of DON JOAQUIN DE VIANA, governor of Montevideo, forbade the great butcheries of cattle and allowed only bulls and oxen over 5 years of age and the male calves to be killed for butcher's meat. This law favoured the rapid multiplication of cattle which soon stocked the ranches of privated owners, of the Jesuits and of the Crown. FRANCISCO BAUZÁ in his *Historia* mentions two Royal "estancias", one 130 977 and the other 313 480 acres in extent. The Jesuits possessed 370 500 acres,

In 1754 was founded the first "saladero" (an establishment for the salting and drying of meat) but it met with poor success. In 1786 DON FRANCISCO DE MEDINA bought the "estancia real de Colla" and erected on it a large "saladero" for the utilization of all the principal products of the slaughter house, such as hides, flesh, tallow etc. As

many as 1000 head of cattle per day were slaughtered. Laws were passed for the protection of the new industry and "tasajo" or "jerked" beef began to be exported to Cuba and to Porto Rico. The animals which could be bought for 0.30 peso (1*s* 3*d*) when Montevideo was founded fetched five times as much after the erection of Medina's "saladero". At the beginning of the nineteenth century there were more than half-a-dozen "saladeros". The progress of the industry was suspended during the civil wars, but was continued afterwards and much improved.

Improvement of the cattle. — The improvement of the "criollo" cattle began in 1860 with the importation of Durham bulls. Later, this breed was used for breeding by itself, as well as for crossing with the local breed. It is much esteemed in Uruguay as it preserves its characters very well, and produces crosses which attain weights of 1100 and 1320 lbs. when fattened on the pastures. Their meat fetches as much as 2.1*d* per lb. live weight.

The importation of Herefords began in 1864. They are bred on the same system as the Durham to which they are preferred by many breeders, especially in the North of the Republic, because they are more suitable for the open country.

The Devon breed was introduced in the distret of Paysandu in 1874, it has not spread much, but has found a good market in the South of Brazil where it is imported to improve the native breed. Neither has the Polled Augus breed spread much, (in the district of Salto) notwithstanding the fact that it has become perfectly acclimatized and yields excellent meat. As the lasso in still used for handling the cattle, the lack of horns perhaps accounts for its limited distribution in Uruguay. The folloving breeds have also been imported: Polled Durham (in Paysandù); Ayrshire; Simmental (at Piriapolis); Jersey (at Toledo in 1887 where it is bred pure for the production of milk); Dutch (in the district of Canelones) already fairly wide-spread in the country; Red Flemish (in 1910); Black spotted Flemish (imported from Argentina in 1912). But of all the milk breeds the most widely spread is the "criolla", common in the whole of Uruguay. It has a lactation period lasting five or six months and yields about 1.32 gallons of milk per day.

TABLE I. — *Statistics of the live-stock in Uruguay.*

	1860	1900	1908
Cattle	3 632 203	6 827 426	8 192 602
Sheep	1 989 929	18 608 717	26 286 296
Horses	518 218	561 408	556 307
Mules	8'301	22 992	17 671
Pigs	5 831	93 923	180 099
Goats	5 437	20 426	19 951

The rapid rise in the number of cattle in Uruguay is not due merely to the multiplication of the "criolla" breed but to crosses between this breed and the imported breeds. In 1887 the "Associación Rural del

Uruguay" founded the Herd-book in which from that time up to 1913 the following have been entered:

	head		head
Hereford	9 000	Dexter	15
Shorthorn	4 900	Simmenthal	23
Lincolnshire Red Shorthorn	18	Schwyz	7
Devon	134	Flemish spotted	7
Polled Angus	226	» brown	7
Red Polled	54	Jersey	68
Norman	183		

To these numbers should be added that of the grade animals amounting to 157 859 head (1.93 per cent.); that of that of the cross-breds which amounts to 5 204 489 head (63.53 per cent.); that of the "criollos", or 2 690 788 head (32.84 per cent.); and that of the unspecified cattle or 139 466 head (1.70 per cent.).

In Uruguay there are 19 745 farms devoted exclusively to the raising of live stock, 18 602 purely arable and 5 527 of a mixed character.

Formerly all the animals ranged freely on the pastures, the limits between the various estates being marked only by a few boundary stones. The herdsmen ("peones de campo") mounted on horseback, used to ride round and round the cattle for several days and nights until the animals had grown accustomed to sleeping in one particular place called a "rodeo" It was there too that the animals were collected when required, and when a rounding up had been called, the herdsmen ("la peonada") went out into the open pastures with a few trained dogs; they emitted special cries at the sound of which the cattle gathered in the "rodeo". Later the properties began to be surrounded by walls; in 1875 wire fencing was introduced by law; the enclosures were made with five strands of wires fastened to hard wood posts ("mandubay") placed 20 metres (65 ft.) apart with five intermediate pine supports. After this the fenced or walled estates were subdivided into pastures, partly for the purpose of keeping the several kinds and breeds of animals apart. The improvement of the cattle led to greater care being taken of the animals. The owners increased the number of wires round the enclosures to prevent their stock from mingling with that of their neighbours. They are obliged now to brand their cattle and horses, and to mark their sheep, goats and pigs.

In 1877, with the assistance of the State, live stock shows and fairs began to be held, at first at intervals of a few years, then every year in some districts. At present they are very well organized over the greater part of Uruguay. The State contributes subsidies voted by the legislative body and divided among the various districts and societies; other prizes are offered by private persons. In 1895, together with the third national live stock show, the first rural congress was held.

Markets. — As has already been mentioned for 150 years (the so-called "hide period") the sole product of the Uruguay animal husbandry consisted of hides. In 1780 the salt meat industry began with the exportation of

TABLE II.

Year	Number of Shows	Subsidies voted £	Number of animals exibited					Amount of sales £
			Sheep	Cattle	Horses	Pigs	Poultry	
1910	7	6 770	96 312	6 624	129	51	272	54 400
1911	21	11 100	50 943	25 137	421	205	741	147 000
1912	18	6 410	30 491	23 720	114	154	695	179 000

" tasajo " or jerked beef,t o Porto Rico and Cuba which are still the chief consumers. This industry increased the price of cattle five fold in about ten years, from 1.50 pesos (6*s* 4 ½*d*) in 1777 to 8 or 9 pesos (34*s* to 38*s* 3*d*) in 1790, and caused a strong current of emigration from the towns to the country; since then animal husbandry has become the chief source of national wealth. Whilst the cattle was being domesticated and selected, the technique of the salt meat industry was also being improved with regard to the utilization of the main and of the by-products, and, by yielding higher profits, allowed better prices to be paid for the cattle thus further stimulating their multiplication and improvement.

Together with the salt meat industry other industries arose. In 1885 the great meat extract factory belonging to Liebig's Extract of Meat Co. Ltd. (capital £500 000) was erected. At present the salting of meat is still carried on extensively, nevertheless it is gradually being replaced by other methods of turning the raw material to account, as may be seen from the following figures:

Value of products othed than " tasajo ".

Year	Pesos	£
1901	1 860 000	395 250
1905	3 022 000	642 175
1908	3 796 000	806 650

Considering the great development taken by the cold storage industry in Uruguay (it deals at present with about 400 000 head of cattle and 800 000 sheep), and the high customs duties on jerked beef in Cuba and in Brazil (exportation to this latter country has diminished by 3 000 000 pesos or £637 500 per annum), it is easy to foresee that before long the jerked beef industry will be very considerably reduced or will disappear altogether. While the output of the Uruguay " saladeros " diminishes continually, that of the Brazil " saladeros " is always progressing, as the following figures show :

Humber of head of cattle killed in the " saladeros ".

Year	Uruguay	Brazil
1908	467 000	597 000
1909	544 000	660 000
1910	576 000	503 000
1911	446 600	707 000
1912	435 600	902 000

TABLE III.

Products	Value	
	Pesos	£
Wool	63 589 932	13 512 860
Salted hides, (oxen and cows)	24 429 132	5 191 190
Dried » » » »	11 249 166	2 390 448
Salted » (calves)	77 295	16 425
Dried » »	1 312 839	278 978
Hides of unborn cattle	76 089	16 169
Sheep skins	8 940 065	1 899 764
Lambskins	211 751	44 997
Skins of unborn lambs	170 649	36 263
Salted horse hides	121 002	25 713
Dried » »	221 968	47 168
Goat skins	1 060	225
Unspecified skins	7 898	1 678
Salt meat (" tasajo ")	22 699 072	4 823 553
Preserved meat	1 629 487	346 266
Extract of meat	6 725 550	1 429 179
Preserved tougues	816 828	173 576
Frozen meat	575 723	115 967
Frozen lambs	290 367	61 703
Meat, not specified	84 000	17 850
Fat	942 079	200 192
Tallow	7 932 243	1 685 602
Guano	551 617	117 231
Bones and bone ash	580 000	123 251
Hoofs	40 951	8 702
Neat's foot oil	20 000	4 250
Horns	93 238	19 813
Cheese	10 867	2 309
Tripe and sinews	237 129	50 390
Bladders	3 880	824
Other products, not specified	124 210	26 395
Horns of all kinds	722 421	153 514
Live animals	4 652 884	988 738

There are at present in Uruguay 16 " saladeros " 5 preserved meat factories and 2 cold storage establishments.

In 1904 the first cold storage works were erected in Uruguay with capital raised in the country itself. They can deal with 400 head of cattle and 4000 sheep daily. In 1904-05, that is, in its first year, 4302 head of cattle and 102 432 sheep were slaughtered. Last year 30 000 of the former and 300 000 of the latter were dealt with. In 1912 a second cold storage establishement capable of dealing with 700 head of cattle and 2 500 sheep per day began to work. A third is being built by a North American company with a capital of 4 million dollars.

The value of the animal products exported from Uruguay during the five years 1903-1907 amounted to about 160 000 000 pesos (£ 34 000 000) distributed as shown by Table III.

Institutions for the promotion of animal husbandry.— Two of these may be mentioned: " Inspección de ganaderia y agricoltura " (Inspection of Animal Husbandry and Agriculture) and the " Inspección sanitaria animal ".

SECOND PART.

ABSTRACTS

AGRICULTURAL INTELLIGENCE

GENERAL INFORMAION.

401 – **Report of the Government Commission for the Study of the Natural and Agricultural Conditions of Tripoli.** — *Tripolitania settentrionale*: Relazione della Commissione per lo studio agrologico della Tripolitania, nominata con D. M. dell'11 Febbraio 1913, presentata a S. E. il Prof. P. BERTOLINI, Ministro delle Colonie. Vol. I, pp. 1-431, Relazione; Vol. II. pp. 1-343, Studi complementari ed illustrativi; Roma, Ministero delle Colonie, 1913.

DEVELOPMENT OF AGRICULTURE IN DIFFERENT COUNTRIES.

The Minister of State for the Colonies, having recognized the necessity of entrusting a commission of experts with the investigation of the vast problem of the improvement and utilization of land in Tripoli, nominated a Government Commission for the purpose by Ministerial Decrees of February 11 and 14, 1913.

The Commission reached Tripoli on March 1, 1913, and, after spending several months in the colony, forwarded its Report to the Minister for the Colonies, in the month of December of the same year.

The Report is in two parts. The first is the Report proper in which the territory of Tripoli, its agricultural possibilities and the social problem of colonization are considered. The second part contains complementary studies which throw light on the various questions dealt with by the first part.

The duties of the Commission were set forth clearly in the speech delivered by the Minister at its first meeting, when he pointed out that the systematic development of the Colony from the very beginning would depend to a great extent upon the conclusions of the Commission.

Having carried out its instructions, the Commission published at the end of its Report its general conclusions which are here given *in extenso:*

GENERAL CONCLUSIONS.

1. — That part of Tripoli examined by the Commission and to which the present conclusions refer (with the exception of some districts that could not be surveyed and which are named in the Report) is bounded,

as shown in the accompanying maps : on the north and east by the sea from Cape Arrár (great Syrtes) to the Tunisian border ; on the west by the western Jebel and the plain towards the same border ; and to the South by the high plateaux of the interior. The surveyors pushed, as far as Bir Dufán on the eastern plateaux, and into the Mselláta district ; they also visited the borders of the Jebel in the territories of Tarhúna, Garián and Ifren.

2. — The region consists of two prevailing morphological types :

a) large plains and steppes along the coast, with " sebkas " (1) formed by Quaternary and recent deposits, prevailingly sandy, with dunes and hills of stratified rocks belonging to the Secondary and Middle Tertiary formations ;

b) the belt forming the edge of the plateaux consisting mainly of stratified cretaceous formations, tabular in form and slightly dipping to the south ; and, in the eastern part, the Miocene appears and is likewise stratified. A layer of sandy soil covers these plateaux discontinuously, masking to a certain extent the irregularities of the rocky soil.

3. — The climate is warm, temperate, and dry. The yearly rainfall may be considered, at least along the central coast, as being above 420 mm. (about 16 $^{3}/_{4}$ inches). On the plain it diminishes in frequency and in quantity from the coast to the foot of the plateau, whilst on the border of the plateau itself the rainfall is more abundant than on the coast.

Owing to the beneficial effect of the maritime climate, which partly neutralizes that of the Sahara, the flora of the coast up to the edge of the Jebel is of a prevailing mediterranean character. Vegetation presents a stricking contrast during the two periods autumn and winter, and spring and summer, being fairly rich during the former and poor and dried up during the latter. Many types of plants are found, from those most characteristic of arid regions to those common in moist and marshy localities. The most distinct plant formations are the *steppe* on the plains and plateaux and a *pseudoscrub* on the hill and mountain slopes. The former is especially noteworthy on account of its extent and because it expresses accurately the complex conditions present in the soil.

There are three belts of vegetation ; the maritime or mediterranean, the pre-desert or transition, and the desert vegetation which appears only in the southern part of the plateau. In the pre-desert belt the Alfa-grass steppe is important ; it is much reduced or has disappeared altogether in the maritime belt.

4. — There are few superficial streams and no permanent water courses of any importance, with the exception of those originating in the great sources of Taurgha. But the flood waters of the wadies could be utilized for flooding extensive tracts of land and if collected in tanks for watering live stock, and for a limited amount of irrigation especially of new plantations.

Barrages across valleys for the formation of great reservoirs seem to be less suitable.

(1) A dry area or bed of a lake incrusted with salt ; a salt marsh. (*Ed.*).

Almost everywhere in the coastal plains one or more water bearing strata are found, often with somewhat brackish water. The phreatic water table, the only one hitherto utilizable for irrigation, is found at depths varying from a few inches to 50 or 66 feet in the belts nearest the coast, and generally sinks deeper as the distance from the coast increases until in the higher Gefara district it lies at depths of above 260 feet. Its volume is limited and varies from one locality to another, being in general greater in the belts nearer the coast.

As for artesian wells no definite data is as yet available except at Misurata, where the water rises at most from a depth of 280 feet to within 8 ft. 8 in of the surface, but in no great quantity.

5. — The substratum of the surface of the quaternary and recent formations is formed, in the pre-Garián hills, by compact limestones, often flint bearing, and prevailingly marly, also by quartzites and sandstones; and in the Jebel by numerous varieties of limestones, by dolomites, sandstones, marls, gypsum, clay and also eruptive rocks. These various beds of rocks will afford building materials for all purposes.

The coastal plains are fundamentally constituted by a stratum of fine red quartz sand (with *Helix*); in the coast belt, it is found between two beds of sandstone and in some places is covered by white sand dunes, prevailingly calcareous. In the interior the plains consist of large tracts of continental dunes — shifting or consolidated — formed of similar fine reddish quartz sand. The same stratum contains localized and irregular layers of calcareous sand embedded in or lying on the surface of the red sand.

6. — This type of soil, namely the red sands (with *Helix*), occupy the greatest area ; they form the soil of the steppes and of the oases and the basis of the masses of dunes ; they predominate also in the surface layers of the rocky soil of the hills of the plateau. In general they form the layer bearing the phreatic water and give rise to the soil essentially and immediately utilizable for agriculture.

It appears difficult to bring the soil of the " sebkhas " under cultivation, at least for the present.

As for the shifting dunes, steps will have to be taken to fix them in those places where they are dangerous to centres of population, roads, railways and cultivated lands. The means of fixing them have been studied in the Report.

7. — The agricultural soil, as mentioned above, is generally formed by the quaternary red sand, mostly wind blown and granular in structure, with a tendency to uniformity ; it is coarse grained in the agricultural sense, silicious or silico-calcareous and generally deep.

Its productivity is intimately connected with the amount of water which it contains. When this is sufficient the soil is favourable to all plants grown in the warm temperate zone and can yield heavy crops.

8. — The rainfall being scanty, a sufficient amount of moisture cannot be had without irrigation. Nevertheless by flooding the land in the autumn and winter with the water brought down by the torrents, a satisfactory yield

can be obtained from plants whose life cycle lies between autumn and spring.

On the other hand, with perfectly dry cultivation, some trees can be profitably grown, such as olives, almonds, vines, carobs, prickly pears, besides any cereal, such as barley, provided suitable systems of cultivation be adopted.

9) At present the following types of holding exist :

a) *Irrigated garden holdings*, in which fruit trees and field crops are grown together in small holdings, either worked by the owners themselves or let on the share system. They are generally collected together into large or small groups (oases) situated mostly along the coast and but rarely in the interior.

b) The *large enclosed dry holdings*, in which fruit trees are exclusively grown or in which olive groves are intermingled with cereals ; in both cases winter flooding is almost always resorted to. These farms are most frequently situated in hollows in the hills.

c) *Plantations*, in which olives and figs are grown, without any form or irrigation, either alone or together with cereals. The are found especially in the mountainous districts as in Mselláta and the Garián.

d) *Badia* land, that is the steppe utilized as pasture and, to a limited extent, for the desultory cultivation of cereals.

e) The *wadies* where, in special cases, cereals are grownal most continuously.

10. — Considering the complex conditions of the country, it is evident that the land will only be brought under cultivation partly by observing the greatest economy in utilizing all the available water, and partly by adopting dry farming methods.

With regard to the utilization of subterranean fresh water at no great depth, it will be possible to extend irrigation farming in several localities of the country described in the Report. Thus it may be calculated roughly that, in the limited area examined by the Commission, besides the existing oases, at least 74 100 acres of land can be irrigated. It will also be necessary to study the possibility and the means of utilizing the important springs at Taurgha the water from most of which now runs to waste. It will also be possible to extend the flooding system in many depressions of the hills, and it will be advisable to investigate the possible utilization on the plains of water from the torrents which now flow into the sea.

On almost all the rest of the cultivable area profitable returns can be obtained from the plantations and field crops mentioned above as being suitable to dry lands, provided they be treated on a rational system.

On that part of the steppes which will not be brought under cultivation, animal husbandry can be improved, especially with regard to sheep raising, so as to render it more profitable than it is at present. The first necessary steps to be taken are the provision of a water supply and the organisation of a sanitary police.

11. — It appears thus, that over the greater part of its area, the

country examined by the Commission is suitable for agriculture and consequently for some form of colonization.

This conclusion is reached, not only by a study of the factors which contribute to form the physical environment, of the spontaneous vegetation and of existing farming conditions, but also by comparing the country with central and southern Tunis where agriculture has greatly developed and where the general conditions, though similar, are less favourable than those of Tripoli.

12. — No colonisation undertaking should ignore the native methods of farming, both in the dry and irrigated lands, for they are the result of centuries of practice.

The types of holdings which might most advantageously be selected by future colonists are the following :

a) *Irrigated holdings*, within the above mentioned areas, for very intensive cultivation and with the production of early fruit and vegetables as well as various industrial plants.

b) *Completely dry or periodically flooded holdings* of considerable extent, 500 or 750 acres, in which a mixed system of farming should be adopted namely plantations and field crops.

c) *Pastoral holdings*, based chiefly on sheep farming and consisting of a farm or central nucleus and a variable area of steppe for grazing purposes.

Dry enclosed holdings may also be adopted under certain circumstances by colonists, but this type of holding seems to be the least suitable.

13. — In general it seems advisable to employ chiefly native labour, especially unskilled labour. Consequently colonization will have to be brought about by the association of Italian capital and management with native labour, either on land which has become the property of the Italians or on land belonging to the Arabs. Such association seems especially indispensable for some types of farms such as the dry enclosed farm, the pastoral farm and the mixed plantation and field crop farm. In special cases all the work might be performed by Italians.

Other forms of association between colonists and natives will no doubt develop with practical experience.

14. — In order to enable the work of colonization to proceed regularly and relatively rapidly it appears necessary :

a) to prepare plans of colonization in determined localities and on lands that present a variety of conditions and to which different agricultural systems may be applied according to the different forms of land tenure. Further, a detailed survey of the country such in its present condition must be made ;

b) to carry out a large number of practical experiments, directed by a State Agricultural Bureau situated in the colony. The details of the experiments will be found in various parts of the Report.

15. — It will be advisable to entrust some of the above mentioned colonization experiments to associations and to private undertakings, and also to allow both natives associated with Italians or Italian purchasers full

liberty to undertake colonization schemes on land ascertained to be private property.

16. — Lastly a recommendation is made to continue the investigation of the vast territory to the south of the country dealt with by the Commission, in order to ascertain the extent and the characters of the land suitable for colonization — on the existence of which very incomplete data are at present available — and also to discover whether there exist minerals or vegetable products in sufficient quantities to enhance the economic value of Tripoli.

402 – **Popular Agricultural Education in Hungary.** — BALKÁNYI, B. in *Mezögazdasági Szemle*, Year XXXII, Part. I, pp, 1-7, and Part 2, pp. 67-72. Budapest, January and February, 1914.

The first step towards popular agricultural education in Hungary dates back to 1868, year in which the law XXXVIII made by the eminent statesman, Baron JOSEPH EÖTVÖS came into force. This law made it compulsory that the first principles of agriculture should be taught in primary schools. It remained however a dead letter.

In 1896, an Order of the Minister of Public Instruction made agricultural education the chief object of the complementary schools, or so-called "repetition" schools, and with the help of the Minister of Agriculture, regulations were made for their organization and curriculum. At the same time the agricultural instruction of school teachers was provided for, and subsidies were granted to cover the extra fees received by the teachers from those local governments which were willing to undergo the expense attendant upon the creation of these schools. According to the above Order all communes in which the greater part of the inhabitants were engaged in agricultural pursuits and whose primary schools possessed more than one teacher, were obliged to institute these rural complementary schools. The said Order regulates the amounts of the grants, the hours of instruction, makes compulsory the attendance of boys between 12 and 15 years of age, establishes the locality of the schools, nominates their teachers and provides for their inspection. It was thus only in 1896 that compulsory popular agricultural education began in Hungary, and it met with numerous obstacles from the start. In order to prepare the rural teachers the Ministry instituted some summer agricultural courses for them, which were attended every year by several hundreds of teachers. Besides this, immediately after the publication of the Order, it was decided that some teachers should receive a more thorough agricultural training and to this end each year 12 to 15 rural teachers, holding scholarships, were sent to agricultural colleges for two years after which they were appointed as special teachers in the complementary schools of the large communes and entrusted with the management of a model farm.

Thus from the outset elementary agricultural instruction was imparted in two types of schools : 1) The agricultural complementary school attached to the primary day school in small communes, where the teacher of the day school is also entrusted with the teaching of agriculture and with the care of the garden, nursery, market garden and vineyard ; 2) the type of school

for the large communes and including two degrees: *a*) complementary agricultural courses at the primary dayschools; *b*) independently organized elementary agricultural schools with specially trained teachers who have attended a two year's agricultural course (1) and who manage a school farm of about 28 ½ acres, the land and the original equipment of which are supplied by the respective communes. During the last 17 years, these schools, especially those organized independently with special teachers, have specialized according to their districts and devoted themselves more particularly either to general farming, vine-growing, fruit and vegetable growing or to forestry.

The communes having supplied the school farms with their original equipment in live and dead stock the upkeep of these schools is defrayed by fines inflicted for injustified absence, by 80 per cent. of the net returns of the experiment fields (20 per cent. being due to the teachers), by the interest of the foundation fund (if there is one), by the sum voted by the commune and by State grants.

In 1902 the rural complementary schools received State grants amounting to £6250; in 1912 these amounted to £25 331 for ordinary expenses and £13 125 for extraordinary ones.

The number of students has also increased. The organization of new schools is chiefly due to the initiative of the Government and very rarely to agricultural associations. Though the results hitherto obtained are not satisfactory, for out of the half million children subject to compulsory education the greater part of whom are children of small farmers, only 15 000 to 16 000 attend the independent elementary agricultural schools, the efforts and the zeal of the Government deserve high commendation, as it has to contend with the indolence of many communes who use every means in their power to free themselves from the duty of establishing these elementary agricultural schools. To remedy this state of things the writer proposes that the Government should adopt more stringent measures to oblige the communes to found such schools and to endow them with the land required for their experiments, and, at the same time, that the complementary schools attached to primary schools be converted into elementary agricultural schools.

403 – **The Institute for Agricultural Botany and the Institute for Seed Selection in Bavaria.** — I. Hiltner, L. in *Landwirtschaftliches Jahrbuch für Bayern*. Year 3, No. 13, pp. 726-741. Munich 1913. — Kiessling, L. *Ibid.*, pp. 842-756.

I. The writer gives an account of the work of the Royal Bavarian Institute for Agricultural Botany which includes departments for seed control, soil bacteriology, field experiments, and plant protection. Amongst other things, the Institute established, a year ago, the practice of applying a lead seal to sacks of clover and grass-seed destined for the market. These seeds are first thoroughly examined, and the Institute is thus able to guarantee that they possess the characters set forth.

(1) There is at present a much esteemed primary Normal State School for teachers at Komáron, which turns out every year about, 15 specially trained teachers.

The manuring experiments carried out throughout the kingdom are directed by the Institute, the staff of the latter being assisted by the State Instructors in Agriculture.

The sale of poisoned grain for the destruction of field mice, is not a monopoly of the Institute. The course of the mouse plague during the last 10 years is now being worked out cartographically by the Institute.

II. The Institute for seed selection in the Kingdom of Bavaria now possesses 56 branches in various parts of the country where plant breeding is carried out. The Institute has founded Agricultural Associations throughout Bavaria, in order to encourage arable farming and holds annual shows, where prizes are given for the best produce. Field variety trials are carried out under the direction of the Institute.

AGRICULTURAL INSTITUTIONS.

404 - **Union of Women's Agricultural Associations in Prussia.** — *Zentralblatt der Preuzeichen Landwirtschafts kammern.* Year 13, No. 10, pp. 76-77. Berlin, March 9, 1914.

At a meeting of the Provincial Unions of the Women's Agricultural Associations of Prussia held in Berlin on February 15, 1914, it was decided to found a Prussian National Union of Women's Agricultural Associations with its seat in Berlin. The object of this National Union, is according to its statutes, the creation of a centre for the work of the Provincial Unions, and of a body representing their common interests, especially with regard to the following questions :

1. The teaching of domestic science.

2. Increasing of the productivity of the rural domestic industries by organising the sale of fresh produce in towns.

3. Promotion of fruit growing and market gardening, of bee and poultry keeping and of other branches of rural domestic economy.

4. Control of emigration from the country.

AGRICULTURAL SHOWS AND CONGRESSES.

405 – **Agricultural Shows.**

Belgium.

1914 Nov. 28-30, Ghent. — Yearly Poultry Show organized by the "Het Neerhof Association". Address to M. Heindrix, Secretary, 3 Rue du Saint Esprit, Ghent.

Dec. 12-14, Liège. — Great International Poultry Show organized by the "Union avicole de la province de Liège". Address to G. Wodons, Château de Lourin, Aus (Belgium).

France.

1915 — Competition of flax growing, organized by the "Comité linier de France". Prospectus on application to Albert Durand, Secretary of the "Comité linier", 15 Rue du Sec-Arembault, Lille (Nord).

1914 June 27-July 7, Rosny-sous-Bois. — General "Horticultural Show" organized by the Vincennes Horticultural Society. Address to E. Pacotto, president of the organizing committee, 11 Rue de la Marseillaise, Vincennes.

1915 Paris. — International show organized by the Horticultural Section of the International Exhibitions Committee.

1915 Jan. 9-11, Lille. — International poultry show. Apply to M. Desreumaux, 62 rue Franklin, Roubaix (Nord).

Germany.

1914 June 17-19, Marienburg (West Prussia). — Fair for saddle and carriage horses.

July 4-8, Görlitz. — Agricultural and Live Stock Show.

Hungary.

1914 July 25-30, Presburg (Pozsony). — Apicultural Show held under the auspices of the Ministry of Agriculture in connection with the fifty-ninth meeting of the Germany, Austrian and Hungarian bee-keepers. Address to J. Valló, director of the exhibition, 13 Duna, Pozsony.

Italy.

1914 June, Noto. — Oenological and ampelographical Show held under the auspices of the "Reale Cantina sperimentale" on the twenty-fifth anniversary of its foundation.

June 15-Sept. 15, Turin. — International Show of Apicultural Produce, held under the patronage of the International Museum of Apiculture and Sericulture at Turin. Address to the Management of the Museum, 44 Via Carlo Alberto. Turin.

406 – **Agricultural Congresses.**

France.

1914 October, Reims. — Third French Cold Storage Congress held by the "Association Française du Froid." The congress will be divided into the following section: 1. Liquefied gases and frigorific plant; 2. Cold storage applied to agriculture and to foodstuffs; 3. Cold storage applied to the industries; 4. Transport in cold storage; 5. Legislation and education; 6. Cold storage applied to hygiene and medicine.

Hungary.

1914 July, 25-30, Presburg (Pozsony). — Fifty-ninth meeting of German, Austrian and Hungarian Agriculturists.

Russia.

1915 August 8-14 (July 26-, August 1, Russian calendar), Sairt Petersburg. — Ninth International Congress of Applied Chemistry, organized under the presidency of Prof. P. Walden, Riga. The fifth section of the Congress will deal with the chemistry and technology of sugar. The seat of the organizing committee is at the Laboratory of the Association of Russian Sugar Manufacturers, at Kiew, Meringowsk, 3.

Spain.

1914 July 20-August 9, Barcelona. — Eighth International Congress of Commercial Expansion, divided into three sections: *a*) Economic and Social Spain; *b*) Artistic Spain, *c*) Spanish America.

Switzerland.

1914 June 8-10, Berne. — Sixth international dairy congress. — 1st section, hygiene; 2nd section, chemistry and bacteriology; 3rd section, dairy economics; 4th section general trade. Apply to Prof. Burri, Secretary-General, Berne.

United States.

1914 October 7-17, Wichita, Kansas. — Eleventh Dry-farming Congress.

1915 September 20-25, San Francisco. — International Congress of Mechanics held during the International Exhibition in connection with the opening of the Panama Canal.

CROPS AND CULTIVATION.

407 – **Is the Earth Drying Up?** — GREGORY, J. W. (University of Glasgow) in *The Geographical Journal*, Vol. XLIII Nos. 2 and 3, pp. 148-172 and 293-308. London, February and March, 1914. AGRICULTURAL METEOROLOGY.

The writer reconsiders all the evidence on which rests the view that the earth is progressing towards desiccation, and discusses the conclusions founded on the facts. He first distinguishes between climatic changes which occurred in geologic times and those which have occurred in historic times, and, limiting his enquiry to the latter, Palestine is taken as a good example

of a country said to be exhibiting desiccation. Here, however, when the available records dealing with the range of the date palm and the vine are examined, and from other facts recorded by the old Testament writers, no change of climate is indicated, and, moreover, the balance of expert opinion is not in favour of such a change. The same may be said of Egypt. The evidence of climatic changes is next examined in Greece, Cyrenaica, Northern and Western Europe, Hungary and Roumania, Central and Western Asia, Africa, North America and Greenland, with the result that the writer reaches the following conclusion: there may have been widespread climatic changes in late geological times, but in historical times there has been no world-wide change of climate.

" Geological evidence shows how the passage from the climate of the Glacial Period to that of our own day has proceeded on two main lines. In some countries there has been a gradual rise in temperature since the disappearance of the ice, accompanied either by an increase or decrease in humidity. In other countries the glacial conditions were succeeded by a warm dry period, followed again by wetter conditions. This increased humidity characterises the present climates of Scandinavia, Germany, Hungary, Roumania, the eastern and southern part of North America, parts of Africa from Nigeria to Cape Colony, and there is some evidence of the same change following a dry, post-glacial period in England. As an increased rainfall has been demonstrated for so many parts of the world, it is only natural to expect a compensating decrease in other districts ; and there is accordingly a predisposition to accept the claim that central Asia is suffering from increasing desiccation.

" Yet it is well to remember that the extent of such a change may be easily exaggerated by attributing to recent climatic changes the effects of prehistoric variations. For archaeological and historical evidence shows that Central Asia, and even the coasts of Persia and Beluchistan had a very arid climate in the earliest times of which we have human records, that the Caspian Sea was at least as small and as low in the fifth century as it is now, that the African and Asiatic deserts are in places again passing under cultivation. Though it must be admitted that, while there is a strong balance of opinion in favour of the view that the aridity in Asia is being still increased, there are weighty authorities on the other side.

" The explanation of the conflicting views may be that in central Asia the desert is widening in some places and contracting elsewhere. That the total rainfall in central Asia has diminished is, however, probable as an accompaniment to its increase in parts of Europe. Variations in the distribution of rainfall must result from any considerable alteration in the level of the land ; the uplift of a continent must cause the rainfall to become heavier on the margins and lighter in the interior. The increase of rain on the coastlands would however hasten their lowering by denudation, and again the rain would sweep over the interior ; hence the geographical equilibrium, unless checked by renewed uplifts of the coastlands, would restore in time the more even distribution of the rain and revive the desolate regions in the heart of a continent ".

408 – **The Economic Value of Tropical Rains.** — CAPUS, G. in *Annales de Géographie*, Vol. XXIII, No. 128, pp. 109-126. Paris, March 15, 1914.

Systematic analyses of the nitric and ammoniacal nitrogen in the rainfall were carried out at Hanoi, Tonkin, during the eight years 1902-1909.

The total nitric nitrogen brought down by the rain was found to vary considerably from year to year, the two extremes being 14 lbs of nitric acid per acre in 1908 and 64 lbs in 1902, with a mean of 43 lbs over the whole period. The average brought down for each month was closely associated with the average number of days on which thunderstorms occurred, and it was found that the nitric acid content of the rain water was higher in the lighter thunder showers (5 parts per million) than in the heavy downpours, and lowest of all in the winter rains (0.1 to 0.3 parts per million). The annual rainfall over a longer period varied from 39.4 in. to 103.4 in. with an average of 66.9 in. Monthly averages reached a maximum during the summer months, July and August, at which time the maximum amounts of nitric acid were also brought down.

The ammoniacal nitrogen also varied within wide limits, not only with regard to the total amount brought down per acre per annum, which showed a maximum of 17 lbs and a minimum of 4.5 lbs, but also in the various samples of rain water in which the content of ammonia oscillated between 0.1 and 1.8 parts per million.

409 – **The Presence of Some Benzene Derivatives in Soils.** — SHOREY, E. C. (Bureau of Soils, U. S. Dep. of Agr.) in *Journal of Agricultural Research*, Vol. I, No. 5, pp. 357-363, Washington, February 16, 1914.

SOIL PHYSICS, CHEMISTRY AND MICROBIOLOGY.

Benzoic acid, metaoxytoluic acid and vanillin have been isolated in a pure form from the sandy soils of orange groves in Florida. The samples, which consisted of eight soils and their subsoils, were treated with a 2 per cent. caustic soda solution for 6 hours, after which the filtrate was shaken up with ether and the compounds went into solution in the ether. Benzoic acid was found only in one subsoil, and metaoxytoluic acid, though present in several of the soils, only occurred in any quantity in subsoils. Vanillin was found in four out of the sixteen samples. It is estimated that the substances are present in quantities equal to 350 lbs of benzoic acid, 800 lbs of metaoxytoluic acid, and 40 lbs of vanillin per acre in the top 12 inches of the soils investigated.

410 – **The Bacterial Treatment of Peat.** — BOTTOMLEY, W. B. (King's College, London) in *Journal of the Royal Society of Arts*, Vol. LXII, No. 3199, pp. 373-380. London, March 13, 1914.

Raw peat was first treated with a culture solution of an aerobic organism which has the power of converting humic acid into soluble neutral humates, and was then sterilized and inoculated with *Azotobacter chrococcum* and *Bacillus radicicola*. The resulting material, so called " bacterised peat ", contained up to 2.7 per cent of soluble nitrogen and 4.3 of total nitrogen, and had a remarkably stimulating effect on plant development when tested on various potted plants and small plots during 1913.

411 – **The Question of Soil Maps.** — GRAF ZU LEININGEN, in *Naturwissenschaftliche Zeitschrift für Forst und Landwirtschaft*. Year 12, Part 3, pp. 114-122. Stuttgart, March 1914.

The problem of mapping the soil occupies most civilized states at present, but its solution is still distant. The main reason of this is that the maps must satisfy very various demands: Above all they must be of use to practical farmers and foresters.

The writer mentions the high scientific value of the maps of Prussia and Saxony, but complains that they are of much less use to the practical farmer and forester than they are to the geologist. Better but in no wise perfect are the maps of Würtemberg which, it is true, do not profess to be maps of the soil. Their chief disadvantage is lack of clearness. By the use of parallel maps ("Parallelkarten") such as have been introduced by the Royal Hungarian geological Institution this defect could be remedied.

The writer points out the advantages that such maps could have for the farmer. But if the requirements of practical men are to be considered, then they must collaborate with the representatives of applied sciences. In future also more attention should be paid to petrography than has hitherto been the case. The scale should never be smaller than 1 to 25 000.

412 – **Irrigation and Drainage in the United States.** — *The Engineer*, vol. CXVII No. 3031, p. 117. London, January 30, 1914.

The United States Reclamation Service has yielded very satisfactory results with regard to economy and efficiency of work.

The service has expended some £15 000 000 and is now spending about £500 000 per year. Works are being constructed to supply water to about 3 000 000 acres and 1 200 000 acres are already supplied at a cost of £10 to £12 per acre. The Elephant Butte dam now being built on the Rio Grande at a cost of over £500 000 will supply water to lands on both the American and Mexican sides of the river. Many other large dams for mountain reservoirs are under construction. There are also numerous private projets being carried out. That of the Medina Irrigation Co. in Texas has 25 miles of canal from a diversion dam in the Medina River to a tract of 60 000 acres. This crosses the river twice by armoured concrete inverted sypho s, each with twin tubes 8 feet in diameter. The South San Joaquin project includes the Goodwin dam (80 feet high and 460 feet long) on the crest. In several States underground waters are being used for irrigation, mainly in the plains; the pumping being done by petrol engines or electric motors.

The drainage of swamps offers a continuous field for engineering work but mainly as private projects. Some of the drainage is by gravity flow to streams, in other cases by pumping, and by vertical drains through impermeable strata to reach underlying permeable ones. Vast drainage projects are being scientifically and systematically undertaken in Florida.

PERMANENT IMPROVEMENTS DRAINAGE AND IRRIGATION

413 – **Land Reclaimed in the Province of Ravenna, Italy.** — *Il Monitore Tecnico*, Year XX, No 6, p. 119. Milan, February 28, 1914.

Recently the water of the second large drainage canal, the Vela canal, has been introduced into the new main canal on the right of the river Reno.

As a result of this work another extensive area, about 51 870 acres, of the lower Ravenna plain have been reclaimed. Of these, 9 850 were always submerged and 19 760 were only intermittently drained.

The area of the lower Ravenna plain below the Aemilian road between the rivers Sellaro and Lamone is about 164 230 acres ; 57 800 have already been reclaimed, there remain thus still about 56 800 to be drained.

The work was begun by the State in 1904 and will be completed in 1915.

Its total cost will be about £600 000 of which about one half has been spent. Agriculture is extending on the reclaimed land while malaria is gradually disappearing.

414 – **The Hindia Barrage on the Euphrates.** — *The Engineer* Vol. CXVII, No. 3030, pp. 87-89. London, January 23, 1914.

Sir William Willcocks was deputed by the Turkish Government in 1909 to visit Mesopotamia with a view to devising means for reestabling the irrigation of that country, and presented a lengthy report at the end of 1910. He proposed that an expense of £ 150 000 000 be incurred on an extensive scheme of barrages, canals and other irrigation works. It was decided to proceed little by little and to construct first of all a barrage across the Euphrates so as to restore water to the Hilla channel which was almost completely silted up and which once served a wide area of very fertile land reaching nearly to the ruins of Babylon.

The work was commenced in February 1911 and completed in December 1913. In 2 years and 10 months a diversion some 5000 feet long with a barrage across it was constructed ; the original channel of the river was dammed up and the water was turned into the diversion, a head regulator being built for the Hilla channel ; a lock was erected and a new channel cut so as to convey water from the river to a point in the channel beyond where the silting up had occurred.

The accompanying map shows the site and general lay out of the works.

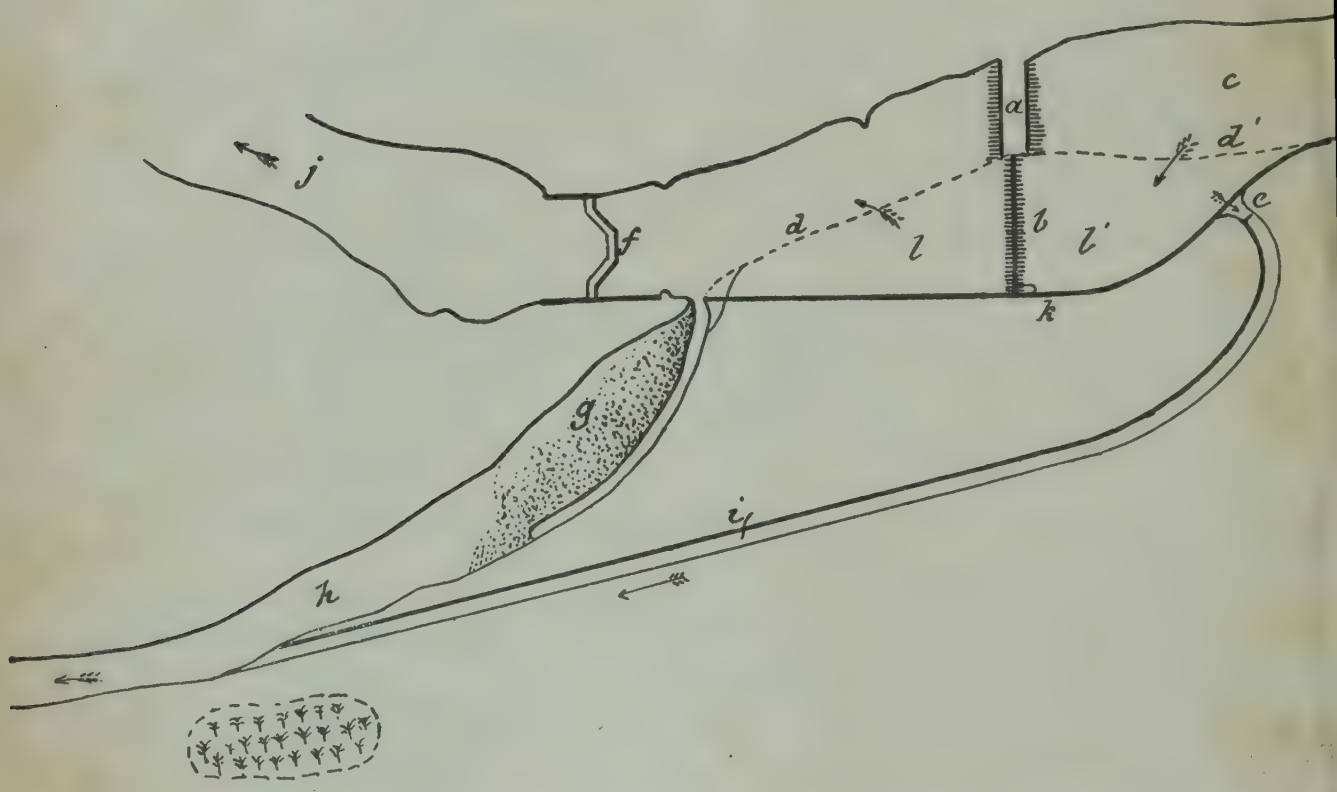
The barrage was so built that no portion of it came in the original bed of the river. It was wholly constructed in the dry when entirely finisted, the new bed was excavated up and downstream, the river bank was demolished and a dam was erected across the old channel.

The ground on which the barrage was erected was composed of fairly hard silt ; it was not deemed necessary to excavate the foundations to any great depth. Under the actual barrage the concrete put in was 3 ft. 3 in. thick and 72 ft. 2 in. wide, throughout the whole length of the barrage (779 ft. 2 in.). On this, brickwork was built to a depth of 6 ft. 7 in. and a width of 65 ft. 7 in., thus forming a foundation for the piers of the barrage.

The whole area covered by the works including the lock was enclosed by a complete fence of interlocking steel piling, and, further, a line of the same piling was run right across the pitching on the downstream side of the barrage. Upstream a stone pitching 32 ft. 6 in. wide and about 3 ft. 3 in. deep was laid on clay puddle. Below the barrage the pitching is 6 ft. 6 in. thick for the first 65 ft. 7 in. *i. e.* up to the transverse line of sheet piling already mentioned, and beyond this, pitching 3 ft. 3 in. deep

is laid on puddle for a distance of 72 ft. to a subsidiary barrage or weir across the channel. Beyond this again there is a brick work apron for 57 ½ ft. and finally 65 ½ ft. of pitching.

The barrage itself has 36 openings each 16 ft. 5 in. wide. The piers are of brickwork 4 ft. 10 in. wide divided into three series of twelve each by two piers 11 ft. 2 in. wide. Their upstream face is vertical and the down-



a) denotes the new earthen dam across the channel of the Euphrates (*c*).
b) New Hindia barrage.
d, *d'*) Original line of bank.
e) Head regulator for the Hilla branch (*h*).
f) Old Hindia barrage.
g) Silted up portion of Hilla branch (*h*)
i) Hilla branch diversion.
j) Hindia branch.
k) Lock.
l, *l'*) Portions excavated after completion of new barrage.

stream face built with four steps which reduces the thickness from 43 ft. at the bottom to 36 ft. at the top. The piers are all joined at the top by brick arches springing at 19 ft. 6 in. Above the arches there in a gangway 12 ft. 4 in. wide as well as two continuous walls 9 ft. 2 in. above the arches for carrying the winch to work the sluices.

There are two sluice gates in each opening, each gate being 17 ft. 3 in. wide and 8 ft. 7 in. high. At one side of the barrage a lock has been formed 26 ft. 3 in. wide and 341 ft. long.

The Hilla head regulator is very similar to the main barrage but it has only six openings, each 9 ft. 10 in. wide. It is provided also with a navigable opening 26 ft. 3 in. wide.

The main barrage will raise the ordinary summer level of the river some 16.ft. 6 in. which will allow an ample supply of water to be diverted into the Hilla channel.

415 – **Growing Crops in Western Nebraska.** – SNYDER W. P., BURR W. W. and BURNETT, E. A. in *Bulletin of the Agricultural Experiment Station of Nebraska*, No. 135, pp. 5 to 41. Lincoln, Nebraska, April 1913. TILLAGE AND METHODS OF CULTIVATION.

The experiments carried on at the North Platte Experiment Substation since 1903 on crop rotation and methods of tillage point to the following conclusions :

1. Land cultivated in the summer when sown to winter wheat, has produced an average of 10 bushels more than twice the crop produced on land not summer tilled.

2. Turkey Red and Kharkov wheats have given the highest yields.

3. During a shortage of moisture thin seeding of winter wheat on summer tilled land has given the best results.

4. Seeding winter wheat by September 15, except in dry years, has given the best average results in this locality.

5. Early seeding of spring wheats has given the best average yields.

6. Spring grains have given a heavier yield on summer tilled land than on land not summer tilled, but only in the case of barley has it been at all possible to summer till for spring grains.

7. Seeding oats, barley and emmer at the rate of 6 pecks per acre has given the best results.

8. In all spring grains the earlier varieties have given the best average results.

9. Durum wheat and barley have produced more feed per acre than any other spring small grains.

10. Ordinary sorghum has proved the best annual forage crop.

11. Brome grass has not proved profitable either as a pasture grass or as a hay crop.

The climate of Western Nebraska is classified as semiarid or subhumid and it varies from year to year from almost humid to almost arid extremes with a mean annual rainfall of 18.5 ins.

416 – **Manurial Experiments on a German Estate in China.** — In *Kali*, Year VIII, pp. 149-152. Halle a. S., March 15, 1914. MANURES AN MANURING.

An account of the experiments carried out in 1911-1912 at the German-Chinese Agricultural School at Tsingtau. Dr. WAGNER points out in his report the great importance of fertilizers to Chinese agriculture in spite of current opinions to the contrary. Ninety per cent. of the population in China are agriculturists, and in many parts of the country the soil consists of the very best kind of strong loam, yet it would appear from evidence collected on the subject that the yields are not as large as in other countries, though there are no available official statistics to confirm the point. An analysis of a Shantung soil carried out by Prof. WOHLTMANN showedthatthe Chinese soil contained more nutrient substances than a normal German soil *i. e.*:

phosphoric acid	0.1 per cent.
potash	0.1 » »
lime and magnesia	1.0 » »
nitrogen	0.1 » »

The chief defects of Chinese tillage are a too superficial cultivation and insufficient manuring. For thousands of years night soil and sweepings have proved the only source of manure, and the Chinese agriculturists have had to make up the deficiency by taking such care of their crops that their system of farming amounts to an extended form of market gardening. With a more ample supply of manure this extensive use of hand labour in the fields would have produced double the crops. Stock raising should prove a help, but is only practised to a slight extent at present, and while awaiting its further development, dressings of fertilizers and deeper cultivation should do much towards increasing yields.

In the manurial trials in question, applications of about 2 cwts. of nitrate of soda, 3 cwts. of superphosphate and 2 ½ cwts. of 30 per cent. potash salts caused a considerable increase of the crop in all cases, varying from 20 and 25 per cent. for peas and beans to 55 per cent. for potatoes and 100 to 150 per cent. for cereals (wheat, barley and maize).

417 – **Sodium Chloride as a Manure; New Investigations Carried out in Sweden.**

1. Söderbaum H. C. in *K. Landtbruks-Akadamiens Handlingar och Tidskrift* 1912, p. 21. — Bolin P. *Ibid.* 1913, p. 585, Stockolm.

The use of sodium chloride as a manure has been largely abandoned since it became known that neither sodium nor chlorine were essential plant foods, yet recent experiments in Sweden in which it has been employed have yielded very encouraging results.

Prof H. C. Söderbaum, director of the Chemical Section of the Swedish Central Experimental Station, carried out a series of pot trials whose results are given in Table I.

Table I.

	Yield in gms.			Percentage increase in yield			Number of grains gms.	Weight of 1000 grains gms.	Ratio, straw / grain
	total	grain	straw	total	grain	straw			
No nitrogen	18.8	5.6	13.2	—	—	—	132	42.6	2.34
Nitrate of soda	56.8	17.3	39.5	100.0	100.0	100.0	353	49.0	2.28
» + sod. chloride	63.2	22.0	41.2	116.8	140.1	106.4	452	48.6	1.88
Amm. chloride	62.7	24.6	38.1	115.5	162.3	94.6	559	44.0	1.55
» + sod. chloride	63.7	27.0	36.7	118.1	182.9	89.3	469	57.6	1.36
Amm. sulphate	51.8	18.7	33.1	86.8	111.9	75.6	418	44.6	1.77
» + sod. chloride	61.4	24.5	36.9	112.1	161.5	90.1	546	44.9	1.50

The beneficial action of sodium chloride cannot be attributed to the action of sodium replacing potassium, for a potash dressing was added in each case. The writer points out further that sodium chloride increased the yield when given with nitrate of soda and sulphate of ammonia, yet failed to do so when given with ammonium chloride, so that it would appear that the fertilising action of the sodium chloride were not due to its sodium content, but rather to its chlorine content, the soil used in the experiment only containing 0.0016 per cent. of the latter element.

In field experiments a dressing of sodium chloride has usually increased the yield both when nitrogen was supplied in the form of a fertilizer containing sodium (nitrate of soda), or of one containing no sodium (calcium cyanamide), and in several cases an increase was observed when the sodium chloride was applied in addition to 180 lbs per acre of 37 per cent. potash salts. In other cases identical results were obtained with a potash dressing and when sodium chloride replaced a corresponding amount of kainit in the dressing.

Sodium chloride affected the various crops rather differently: with roots crops in nine cases out of ten, 430 lbs. of sodium chloride per acre gave better results than 180 lbs. of 37 per cent. potash salts, and similar yields were obtained with 430 lbs. of sodium chloride and 530 lbs. of kainit per acre ; with oats and hay application of sodium chloride also proved beneficial though less effectual than an equal dressing of 37 per cent. potash salts. The writer concludes that applications of sodium chloride might frequently replace potash dressings with advantage, especially in the case of root crops (and mangolds in particular), and that the beneficial effect of the sodium chloride is due to its chlorine content or to some other factor, but not to its sodium content. Further, he considers that the beneficial effect of potash applications are not always due to the fact that potash is a plant food, but may be due in part to a factor analogous to the one reacting in the case of sodium chloride.

418 – **Mixed Dressings of Cyanamide and Superphosphate.** — KOPPEN, H. in *Illustrierte Landwirtschajtliche Zeitung*, N. 18, pp. 181-182. Berlin, March 1914.

The writer has carried out some experiments with the object of ascertaining the advisability of mixtures of cyanamide and superphosphate. Considering it from a purely theoretical point of view it might be expected that, both bodies being very susceptible to chemical reactions, changes might take place in their chemical compositions.

With regard to the nitrogen, the experiments have demonstrated that mixing the two fertilizers does not decrease the active form of this element. With the phosphoric acid however, the case is different, for it has been found that in the mixture of the two artificials, the total amount of water soluble phosphoric acid of the superphosphate retrogrades to the citric acid soluble form, which means a notable decrease of the value of the superphosphate. The phosphoric acid is thus deprived of its most valuable property, namely that of distributing itself over a large area, and by the use of such a mixture no better distribution of phosphoric acid in the soil is obtained than by the use of basic slag.

For this reason the writer considers that the preparations and use of cyanamide superphosphate mixture is not advisable.

419 – **The Composition and Agricultural Value of Carbonate of Lime from Causticising Plant.** — HENDRICK, J. (Marischal College, Aberdeen) in *Journal of the Society of Chemical Industry*, Vol. XXXIII, No. 3. London, February 16, 1914.

In the 58 paper mills situated in Scotland, it is estimated that approximately 20 000 tons of waste lime (expressed as dry material) are produced annually from causticising plant. This material has to be disposed of, and the paper works have in many cases offered it gratis to farmers, but the latter have not availed themselves of the opportunity, for in the first place they found the substance difficult to handle in its wet, pasty condition, and secondly, they were sceptical as to benefits derived from its application. Its use in the undried state is quite possible if farmers will merely cart it on to the land and leave it in heaps to drain and to be subjected to the action of frost, after which it will be spread quite easily; but it can also be dried artificially, and some paper works have already erected the necessary plant for the purpose, and are selling the product to farmers at prices sufficient to cover the costs of drying and marketing. Drying reduced the water content from an average of about 45 per cent. to about 10 per cent. or under. The dried material chiefly consists of carbonate of lime, and may also contain a small quantity of free caustic soda. On the whole the dried samples contain as much "available lime" (*i. e.* available to neutralise acids) in the form of carbonate of lime and hydrate of lime as is contained in ordinary commercial ground limestone, and they contain more than half as much available lime as is contained in ordinary commercial burnt lime.

Some preliminary field trials have been carried out by the writer on the manurial value of waste carbonate of lime applied at the rate of four tons per acre to turnip crops on land known to be infested with finger and toe disease. Simultaneous applications of quicklime (1 and 2 tons per acre) and of gas lime (2 and 4 tons per acre) were also made. In almost every case the application of any form of lime has had a distinctly beneficial effect on the crop, the waste lime and quicklime being specially successful in reducing disease, and, of the three forms of lime, the waste lime has always proved quite as, if not more, effectual than the other two in increasing the crop.

The experiments are being continued.

420 – **A New Manure: Electro-potash** ("**Electro-Kali**"). — SÖDERBAUM, H. G. in *Kungl. Landtbruks-Akadamiens Handlingar och Tidskrift*, Year 53, No. 1, pp. 15-32. Stockholm, 1914.

The price of German potassic salts in much higher is Sweden than in other countries, and the writer reviews all the trials which have been made to utilize felspars, or other potassic rock constituents in Sweden, for the preparation of potassic fertilizers.

Up to the present all attempts have failed, but a new method recently invented by two Swedish workers, A. LINDBLAD and L. YNGSTRÖM appears promising. The raw material is a common rock in Central Sweden called *L.*-

tite or *eurite* similar in chemical composition to a gneiss or felspar, and may contain up to 11 per cent. of potash. Leptite is mixed with coal and iron filings, and treated in an electric oven provided with carbon electrodes at a temperature of 1800° C. approx. At this temperature the silicic acid in the rock is partially reduced to silicon ; this combines with iron to form a silicic iron which collects in the bottom of the oven under a layer of slag consisting chiefly of potassium and aluminium silicate and more soluble than the silicates in the original leptite. The slag, when cold and finely ground forms a grey powder and is sold under the name of electro-potash (" electrokali ").

The principal product, silicic iron, is easily disposed of as an alloy for various metallurgical uses, but in order that the manufacture should prove remunerative, a market must also be found for the electro-potash. The latter was analysed at the Central State Experimental Station and was shown to contain about 11 per cent. of potash, of which 10 per cent. is soluble when the material is treated on the water bath with 20 per cent. hydrochloric acid, while shaking the material with 2 per cent. hydrochloric acid for twelve or twenty four hours dissolved out 6 and 6.5 per cent. respectively.

The writer carried out some pot cultures in which the new manure was tested against sulphate of potash, both being supplied at the rate of 180 lbs of potash per acre. The results show that the electro-potash pots yielded 78 per cent. of the crops obtained on the sulphate of potash pots which is fairly satisfactory as a first experiment. Moreover as it was found possible to increase the solubility of the slag during the year 1913, it does not seem improbable that further trials will yield still better results, so that this new method of using native resources for fertilizing the soil may prove an economic possibility.

421 - **Experiments on the Selection of Spring Wheats from Autumn Wheat in Hungary** (1). — GRABNER EMILE in *Köztelek*, Years 21, No. 16, pp. 474-475. Budapest, February 21, 1914.

PLANT BREEDING.

The varieties of spring wheat at present cultivated in Hungary are not in great favour as the more productive types are late in maturing and produce grain of inferior quality, and the earlier types give low yields. They are only grown on a large scale when the weather conditions in the autumn are unfavourable to the sowing of autumn wheats. The writer proposes to meet the situation by improving the ordinary spring wheats and by the selection of several types of autumn wheat suitable for spring sowing. He gives the result of the first season's work in this direction carried out by the Royal Hungarian Institute for Plant Breeding in co-operation with several plant breeders, during which, a large number of native and foreign varieties were tried. Some of these varieties continued to tiller till August, others, though late, produced stems and ears and others again produced grains.

(1) See also : Nos. 325, 326, *B.* February 1912. — No. 651, *B.* April 1912. — No. 353, *B.* April 1913. — Nos. 223, 224, *B.* March 1914.

422 – **Hybrids between *Triticum monoccum* and other Species of Wheat.** — BLARINGHEM, M. in the *Comptes Rendus hebdomadaires des Séances de l'Académie des Sciences*, Vol. 158, No. 5, pp. 346-349, + 1 Fig. Paris, February 1914.

Various workers have tried to obtain fertile hybrids between *Triticum monococcum* and other species of wheat but without success. This has led to the belief that *T. monococcum* was of different botanical origin and formed a distinct class of its own. The writer has made several attempts to obtain hybrids of *T. monococcum* and was successful only with the pollen of *T. durum* and *T. polonicum*, which belong to a different group of wheats. No success was obtained when *T. monococcum* was used as the male parent. The differences in the degree of fertility and the uncertainty of the results among the different strains of each species point to the existence of an individual sexual affinity between the different strains of the parental species.

The three hybrid seeds obtained by crossing *T. monococcum* and *T. durum* var. *macaroni* gave rise to three vigorous plants, one of which was sterile and grew to a height of 6 ft. The other two produced seed which produced more fertile plants without segregation of characters. By anology with *Aegilops speltae formis*, Jordan, the writer has named this new species *Triticum dicoccoforme*. The hydrids between *T. monococcum* and *T. polonicum* var. *compactum*, showed the dominance of the starchy albumen and the round and finely wrinkled surface characteristic of the latter parent.

423 – **The Inheritance of Quantitative Characters in Maize** (1). — EMERSON R. A, and EAST E. M. in the *Agricultural Experiment Station of Nebraska, Research Bulletin* No. 22, pp. 120, + Figs 21. Lincoln, Nebraska, April 1913.

The theory of inheritance by multiple factors has been applied by the writers in the study of the inheritance of quantitative characters in maize.

The experiments were begun in 1906 and have been conducted at the Connecticut Agricultural Experiment Station at New Haven, at the Bussey Institution of Harvard University, and at the Nebraska Agricultural Experiment Station at Lincoln. The characters studied in these experiments were :

1) number of rows per ear, 2) length of ear, 3) diameter of ear, 4) weight of seeds, 5) breadth of seeds, 6) height of plants, 7) number of nodes, 8) length of internode, 9) number of stalks per plant and 10) earliness of maturity.

Some of these characters, especially length of ear, weight of seeds and height of stem, are affected by environment and the stimulus to development due to heterozygosity. Thus it becomes difficult to determine to what class a particular individual really belongs. Gametic impurity of the parents is also a source of error and it is extremely difficult to obtain parents of the simple type, (x + *aa bb cc*) and (x + AA BB CC).

The degree of heterozygosity of the parents is always indicated by excessive variation in F_1, thus apparently diminishing the range of variation due to segregation and recombination of factors in F_2. Crosses which produce

(1) See also original article p. 861. *B.* June 1913.

excessive variation in F_1 are therefore neglected. Again, the variation in F_2 may exceed that in F_1 in a degree unsuspected by the difference in size of the parents. For example a cross between parents of the type AA BB CC and DD EE FF (1) would give rise in F_2 and F_3 generations to progeny of the types *aa bb cc dd ee ff* and AA BB CC DD EE FF and this is what would have occurred if these had been the original parents types.

Summary of the results of the experiments :

1) *Number of rows per ear.* — Eight crosses between 8-rowed, 12-rowed, 16-rowed and 20-rowed types were studied. In nearly every case the F_1 generation was intermediate between the parents, and in most cases the F_2 generation had a wider range than F_1 and included both parent types. Where F_3 families were grown the parent types were recovered in every case.

The resuts of a cross between Tom Thumb Pop and Missouri Dent are given in Table I :

TABLE I.

Number	Year	Generation	No. of rous of parents	Classes for number of rows per ear											Mean
				8	10	12	14	16	18	20	22	24	26	28	
Missouri Dent.	—	P	—	—	—	1	1	7	9	6	1	—	—	—	17.7 (?)
Tom Thumb Pop	—	P	—	—	2	15	3	—	—	—	—	—	—	—	11.4 (?)
F_1 Generation.	—	F_1	—	—	—	—	—	2	2	1	—	—	—	—	(?)
1127	1911	F_2	—	—	1	13	26	15	6	2	—	—	—	—	14.57 ± 0.18
1142	1911	F_3	12	1	7	46	17	3	—	—	—	—	—	—	12.38 ± 0.11
1144	1911	F_3	14	—	1	15	29	33	3	—	—	—	—	—	14.54 ± 0.13
1140	1911	F_3	20	—	—	—	—	1	10	31	20	9	3	1	21.04 ± 0.17

2. *Length of ears.* — The inheritance of this character was studied in three crosses. In one case the F_1 generation had ears as long as those of the long-eared parent, doubtless due to the heterozygosity of one of the parents, for the means of the F_2 families were distinctly intermediate between the parental means. In most cases the progeny of the F_2 generations completely bridged the gap between the parents.

3. *Diameter of ears.* — This character was studied in two crosses. The F_1 generation was intermediate in diameter between those of the parents, but somewhat nearer the large-eared than the small-eared variety. The parent types were not recovered in F_3 but the several F_3 lots were very distinct.

4. *Weight of seeds.* — Only one cross was studied for this character. The distinct types of seed-weight were isolated in F_3, though neither parent

(1) The real gametic composition of these parents would appear to be AA BB CC *dd ee ff* and *aa bb cc* DD EE FF respectively. (*Ed.*).

type was recovered. The great variability of several F_3 lots indicated sufficient heterozygosity to enable the isolation of parent types on further selection.

5. *Breadth of seeds.* — Two crosses were studied for this character, and in both cases the F_1 generation was distinctly intermediate in character between the parents. Practically all the classes from below the mean of the small seeded parent to above the mean of the large seeded parent were obtained in the F_2 generation. Two of the F_3 lots of the cross between Missouri Dent and Tom Thumb Pop, grown from small- seeded individuals had seeds practically as small as those of the small seeded parent. Since the total number of F_2 plants was slightly over 300 in each cross, it is thought that Missouri Dent and Tom Thumb Pop probably differed by five or less factors.

6. *Height of Plants* — This character was studied in 4 different crosses. In three of them the F_1 plants were almost as tall as the tall parent and in the fourth they were considerably taller than the mean of the two parents. That this increase in height of the F_1 plants is due to heterozygosity is shown by the fact that in every case the mean height of the F_2 plants is about half way between the heights of the parents, and by the lack of skewness in the F_2 frequency distributions. Few F_2 families were as tall as the tall parent and none was quite as short as the short parent. In some of the extreme F_3 lots, the variability was sufficient to make it probable that types like the parents could be isolated in the next generation,

The results obtained in the cross between Tom Thumb Pop and Missouri Dent are given in Table II :

In some of these crosses the character for height was separated into its components-number of nodes and length of internode. The inheritance of number of nodes was exactly what would be expected according to the theory of multiple factors, *i. e.* the F_1 generation was intermediate in character, the F_2 showed wide range of variation and the F_3 families included types resembling the parents.

7. *Length of internode.* — This character was so much affected by heterozygosis that in some cases the F_1 generation had longer internodes than the long-internode parent. One of the F_2 families had a range of variation extending from considerably below the minus extreme of the short-internode parent to much above the plus extreme of the long-internode parent, and considerably above the plus extreme of the heterozygous F_1. This extreme range therefore indicated impurity of the parents and new combinations of factors in F_2.

8. *Number of tillers.* — The F_1 generation was intermediate in number of stalks per plant and F_2 showed great variation. The F_3 families contained some one-stalked types and others with a somewhat larger mean number of stalks than the tillering parent and a range of variation so great as to suggest the possibility of isolating types with a still larger number of stalks. In one of the crosses the few-stalked parent was taller than the many stalked parent. With respect to total length of stalk the parents were almost equal, but the total length of stalk of F_1 almost equalled the combined

TABLE II.

No.	Year	Gen.	Class centres in decimetres for height of plants																						Coef. of var.
			6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	
146	1909	P																←						→		
151 (1)	1909	P			←			→																		
170	1909	F_1									←							→								
509 . .	1910	F_1										1	3	5	7	4										6.39 ± 0.68
1128 . .	1911	F_2				1	1		3	3	5	11	7	4	8	12	10	5	5	2	3	1	1			19.40 ± 1.09
1132 . .	1911	F_3			2	5	11	11	5	5	1															13.20 ± 1.01
1141 . .	1911	F_3									1	3	5	7	6	11	17	17	13	3	4					11.43 ± 0.59
1149 . .	1911	F_3																5	6	12	6	12	12	10	6	9.28 ± 0.51

(1) Variation indicated by arrows.

stalk length of both parents, and that of the F_2 generation was considerably greater than that of either parent, while some of the F_3 lots had a mean total length of stalk twice as great as that of the long stalked parent. This increased stalk length shows a lack of correlation, either physiological or gametic, between number of stalks and height of plant, and is probably due to a combination of the factors influencing total stalk length, some of which come from one parent and some from the other.

9. *Earliness.* — The F_1 plants were intermediate between their parents. The F_2 generation included all types between the parents and distinct types were obtained in the F_3 some of which were practically as early as the early parent.

Conclusion.

Thus the inheritance of the above characters in maize is what would be expected if the quantitative differences were due to numerous factors inherited in a strictly Mendelian manner. The interpretation of the results is sometimes made difficult by gametic and physiological correlations, but this does not counteract the effect of segregation of factors.

Application of the theory in Plant Breeding.

The principal use of hybridisation in plant breeding is to secure new combinations of the characters present in the parents with a view to selecting and preserving the desirable ones. The number of factors by which distinct commercial sorts of crop plants are differentiated is sometimes very large. For example, suppose it is desired to produce a better silage corn by combining the length of stalk of the few-stalked dent varieties with the number of stalks of the short many-stalked flint varieties. Suppose that these varieties differ by 5 Mendelian factors influencing height of plant and by 5 factors affecting number of stalks. An F_2 generation of about 1000 plants, *i. e.* about one tenth acre plot, would be required to give an even chance of recovering a many-stalked type like one parent or a tall-stalked type like the other parent. Perhaps 3 or 4 times this number should grown to be at all sure of recovering the parent types. But with this number of plants there could be no hope that any of the very tall parents would also have very many stalks. With parents differing by 10 factors (5 for height and 5 for number of stalks), over one million F_2 plants or over 100 acres, would be required for an even chance of getting the desired combination of characters, and at least 2 or 3 times this number should be grown to make sure of the results. This method is obviously impossible under ordinary conditions. The desired combination of characters can however be obtained from a smaller number of plants by taking more generations. As many F_2 plants as practicable should be grown and selection made of such plants as combine most nearly the desired number of stalks and height of plants. By continuing this selection through succeeding generations the desired result will be obtained.

When dealing with plants like corn that are much more vigorous when many characters are heterozygous, the breeder will find it necessary to practise cross breeding between different isolated types. He should therefore isolate several types possessing the particular character desired but which differ by sufficient minor characters, quantitative or qualitative, to insure a vigorous development on crossing. The breeder who selects for, say, high-oil content, from open pollinated plants will, if he persists long enough, succeed in producing a type with enough factors for oil production to rank as a high-oil type and with these factors sufficiently homozygous to insure comparative constancy, and at the same time with a sufficient number of minor factors heterozygous, to insure a comparatively vigorous strain. But by self pollination and selection, several practically homozygous high oil strains could have been secured in much less time, and these would have been sufficiently unlike in other less important factors to ensure a vigorous heterozygote on crossing. In breeding work requiring costly chemical analysis, obtaining results in as few years and with as few analyses as possible is an important consideration.

424 – **Determination of the Varieties of *Triticum monococcum* L.** — FLAKSPERGER, C. in *Bulletin für angewandte Botanik*, Year 6, No. 10, pp. 689-695. (German abstract) + 8 Fig. St. Petersburg, October 1913.

CEREAL AND PULSE CROPS.

As the result of a series of experiments on *Triticum monococcum*, the writer gives the following characters for the determination of varieties.

A. — Joints of the rachis covered with dense white hairs. Base of spikelet covered with dense bristles. Wild types of *T. monococcum* (Group *aegilopioides* Asch. and Gr.).

I. Ears yellow or light brown, empty glumes with narrow triangular notches, alternately 2 ½ mm. and 1 ½ mm. long. Flowering glumes with long awns. Awns of almost equal length or one half shorter than another. Var. *Thaoudar* Reut., pr. sp.

II. Empty glumes erect, with triangular notches alternately 1 ½ mm. and ½ mm. long. Awn of the sterile flower very short and often limited to a sharp point:

1. Empty glumes glabrous.
   (*a*) Ear yellow, var. *Boeoticum* Boiss, pr. sp.
   (*b*) Ear red, awns black, var. *Larionowi* m.
   (*c*) Ear black, var. *Pancici* m.
2. Empty glumes velvety.

B. — Internodes of the rachis glabrous. Base of the spikelet glabrous or only slightly hairy. Cultivated varieties of *T. monococcum* (group *cereale* Asch. and Gr.).

I. Empty glumes incompletely covered with hairs, slightly wrinkled in the upper part of the keel. Ear red, not shiny, var. *Hornemannii* Clem.

II. Empty glumes glabrous:

1. Spikelets quite yellow, not shin. Empty glumes slightly wrinkled at the keel; var. *laetissimun* Körn.
2. Ear red or light red.

(*a*) Ear dull, empty glumes slightly wrinkled at the upper part of the keel without ridges or only slightly marked ; var. *flavescens* Kon.

(*b*) Ear shiny, empty glumes glossy at the keel, or slightly wrinkled at the upper part, or strongly ridged ; var. *vulgare* Körn.

425 – **Hungarian Experiments on the Cultivation of an Early Variety of Maize with Soft Grains, 1912–13.** — SURÁNGI JÁNOS in *Köztelek*, Year 24, No. 16, pp. 473-474. Budapest, February 21, 1914.

In Hungary, except for certain elevated regions, early varieties of maize giving low yields are not grown to any considerable extent, the later and more productive varieties being prefered. The better known early varieties still cultivated are the " cinquantino ", the " pignoletto " and the " Alcsuth ", a new type obtained from the latter by selection. Their cultivation however has become difficult even in the districts in which the early varieties are more suitable, partly because their cultural requirements entail more manual labour and partly because their hard grains are not suitable for feeding to stock. As a result of this the Royal Agricultural Experiment Station at Magyarovar has undertaken experiments with the most varied types of maize.

In the course of these experiments a variety known as " Moldova " with soft yellow grains, received from Baron Jean Kapri, agriculturist of Banest (Roumania), attracted attention by its rapid development which appeared to exceed that of the earliest variety under experiment. " Moldova " is a local variety not yet subjected to selection and leaving much to be desired regarding its grain, rachis, and shape of ear which averages from 12 to 16 rows of seed. Nevertheless, on account of its remarkable earliness, the station has carried out experiments to determine its cultural value under the various soil, climatic and economic conditions in Hungary.

During the seasons 1912-1913, 59 domains in the most varied regions of the country took part in the trials, "Alcsuth " being used as the standard of comparison. " Moldava " proved earlier than " Alcsuth " but a lighter yielder, and requires considerable improvement in respect of various characters before being adopted in practice.

426 – **Researches on the " Topping " and " Stripping " of Maize in Italy.** — MANARESI, A. and BERNARDI, G. in *Le Stazioni sperimentali agrarie italiane*, Vol. XLVII, Part I, pp. 33-40. Modane 1914.

These investigations deal with the influence of the time of topping and stripping maize plants on the characters and chemical composition of the grains. The results are summarised in the adjoining table :

It will be seen that the weight of 100 grains, the weight per bushel and the density increase as the plant becomes more mature, *i. e.* as the topping and stripping are delayed or not carried out at all. The germinating power, on the contrary, does not increase to any considerable extent, and the same may be said of the percentages of ash and phosphoric acid. The humidity remains almost constant at about 10 per cent., and was only determined to account for certain variations in the density. With regard to total nitrogen, CONTI found that the percentage was greater at

No. of row	Date of toppping and stripping	No. ears analysed	Total weight		Mean weight		Weight of		Germinating power	Density	Humidity	Raw ash	Phosporic acid in		Total nitrogen
			ears	grains	of one ear	of grain in one ear	100 grains	1 bushel					dry matter	ash	
			lbs	lbs	lbs	lbs	gms.	lbs	%		%	%	%	%	%
I A	Stripped 25 July 1912 . .	50	9.92	7.63	0.20	0.15	17.48	57.25	94.6	1.130	10.267	1.578	0.837	52.92	1.91
» B	» 1 August » . .	»	13.67	10.49	0.27	0.21	20.03	58.45	95.7	1.219	10.744	1.604	0.751	46.784	1.86
» C	» 7 » » . .	»	17.86	14.04	0.36	0.28	23.60	60.69	97.1	1.236	10.077	1.501	0.753	49.507	1.86
» D	» 16 » » . .	»	23.37	18.43	0.47	0.37	30.81	61.33	95.6	1.254	9.751	1.460	0.777	53.216	1.99
» E	» 21 » » . .	»	23.81	17.81	0.48	0.36	31.12	61.57	96.1	1.260	9.542	1.450	0.696	48.340	1.83
» F	Not stripped	»	24.03	17.59	0.48	0.35	31.68	61.33	96.6	1.257	9.974	1.540	0.750	48.707	1.89
» G	» »	»	24.25	17.84	0.49	0.36	32.05	61.25	97.8	1.249	10.237	1.493	0.774	57.889	1.80
II A	Topped 8 August 1912 . .	76.5	30.49	26.39	0.40	0.32	33.67	60.45	96.1	1.247	10.460	1.343	0.684	50.913	1.70
	Stripped 22 » » . .														
» B	Topped » » » . .	45 »	16.14	12.52	0.36	0.28	32.85	60.53	96.6	1.256	10.690	1.298	0.665	57.368	1.68
	Stripped » » » . .														
» C	Topped » » » . .	41 »	17.55	13.23	0.43	0.32	32.72	60.45	93.8	1.250	10.940	1.475	0.728	48.408	1.63
» D	Normal	56.5	25.11	18.81	0.44	0.33	34.89	60.53	95.3	1.249	10.860	1.307	0.690	52.798	1.72
III A	Topped 19 Aug. 1913 . .	49	21.56	17.97	0.44	0.37	34.35	60.05	—	—	—	1.571	—	—	1.47
	Stripped 27 » » . .														
» B	Normal	50	23.90	19.40	0.48	0.39	35.47	60.21	—	—	—	1.604	—	—	1.58
IV A	Topped 18 Aug. 1913 . .	45	20.55	16.69	0.46	0.37	34.66	59.97	—	—	—	1.418	—	—	1.48
	Stripped 22 » » . .														
» B	Topped 18 » » . .	80	24.05	19.40	0.50	0.40	36.33	61.25	—	—	—	1.455	—	—	1.50
V A	Topped 23 » » . .	—	—	—	—	—	36.95	59.01	—	—	—	1.795	—	—	1.48
	Stripped 26 » » . .														
» B	Normal	—	—	—	—	—	37.98	59.49	—	—	—	1.625	—	—	1.61

the commencement of the formation of the grain, while these results show an almost constant figure throughout the samples.

The effect of seasonal variations on the grain is shown in the results of series II, III, IV, obtained from crops grown in the same district with the same manurial and cultural conditions, but in different years. Series II are the results of the very dry summer of 1912 while those of II and IV were obtained during the very rainy season of 1913. The grains of the two latter series are not only heavier but larger, richer in ash and poorer in nitrogen.

427 – **Loss in Weight of the Ears of Maize on Drying. Hungarian Experiments.** — ZSIGMOND KISZEL in *Köztelek*, Year 24, No. 16, pp. 472-473. Budapest, February 21, 1914.

Experiments were carried out to estimate the loss of weight undergone by maize during the drying process. This was found to be a very variable quantity being influenced by the variety of the maize, by the kind of drying shed used and by the meteorological conditions.

428 – **The Classification of the Bacteria of Leguminous Plants.** — KLIMMER M. and KRÜGER R. in *Centralblatt für Bakteriologie, Parasitenkunde und Infektionskrankheiten, Abt. II*, Vol. 40, Nos. 11-13, pp. 256-265. Jena, March 1914.

The writers have cultivated *Bacillus radicicola* from 18 species of leguminous plants in serum cultures, and, from observations of the agglutination, complementary formation (" Komplementbindung ") and precipitation effects they divide them into nine distinct groups or species :

The first group includes the bacteria from *Lupinus perennis* L., *L. luteus, L. angustifolius,* and *Ornithopus sativus;* the second group the organisms of *Melilotus albus, Medicago lupulina, M. sativa* and *Trigonella foenum graecum* ; the third those of *Lotus uliginosus, Anthyllis vulneraria* and *Tetragonolobus purpurea* ; the fourth those of *Vicia sativa* and *Pisum arvense.*

The organisms of *Vicia Faba, Trifolium pratense, Phaseolus vulgaris, Soja hispida* and *Onobrychis sativa* constitute distinct species.

ROOT CROPS.

429 – **Selected Strains of Hungarian Potatoes, and their Productivity.**— GRABNER EMILE in *Köztelek*, Year 24, No. 13, pp. 553-556. Budapest, February, 13, 1914.

The Royal Hungarian Institute of Plant Breeding at Magyaróvár conducts field trials from year to year with foreign varieties of potatoes in competition with strains of local varieties selected at the Institute. The results obtained in 1913 show that the Hungarian variety " Margonyai " is the most productive. The highest yields were obtained from " Margonyai VII, III and V ", which gave from 42 800 to 55 200 lbs per acre in good soil. These figures were only reached by two other foreign varieties, viz. " Svites " and " Kürger " which yielded from 48 100 to 49 800 lbs per acre and 53 500 to 55 200 lbs. per acre respectively.

In respect to quantity of starch the variety " Margonyai X " was equal to the best foreign varieties (19.51 to 22 per cent.).

430 – **Manurial Experiments with Potatoes in Hungary, 1913.** — RÉSZ, A. in *Köztelek*, Year 24, No. 22, pp. 719-720. Budapest, March 14, 1914.

An account is given of fertilizer trials with potatoes carried out by the National Agricultural Society of Hungary during the season 1913.

431 – **The Duration of a Lucerne Ley.** — VIVENZA, A. in *Le Stazioni sperimentali Agrarie Italiane*, Vol. XLVII, Part. 2, pp. 97-118 + Plates I-VIII. Modane, 1914.

These experiments on the cultivation of lucerne were conducted at the Experiment Station of the Higher Institute of Agriculture at Pérouse during 1902 to 1912.

The observations and conclusions relate chiefly to the production of forage in relation to the age of the plants and to the rainfall, and also to the formation of turf (stems and roots) in relation to the age and growth of the plants; they cover the whole period from the time of sowing until the clearing of the crop owing to degeneration.

1. The duration of lucerne cannot be definitely determined without taking into account the soil conditions and varieties of the plant. It may vary from a few years to several decades. Under normally good cultivation, the maximum duration is from 15 to 16 years.

2. Under normally good culture conditions the seedlings come up very thickly, and suffer considerable mortality during the first year; in the second year the mortality diminishes and ultimately falls to a constant rate of about 10 per cent. per year.

3. The yield of lucerne under field conditions reaches a normal level after the first year; during the two following years it remains constant or increases slightly, then slowly decreases. These variations are quite distinct from those due to meteorological changes from year to year.

4. The quantity of accumulated vegetable matter (stalk and roots) increases until the 5th year (*i.e.* the 4th year of production). In this particular experiment the quantity of vegetable matter was found equal to 21 960 lbs per acre corresponding to 7 920 lbs per acre of dry matter containing 186 lbs of nitrogen. After the 6th y ar the quantity of residue per unit area decreases, but at a slower rate than the decrease in yield, and independently of any climatic variations.

5. Abundant rainfall increases the yield of lucerne to a considerable extent, the yield being directly proportional to the rainfall during the months of April, May and June.

6. Each particular plant gives its maximum yield under field conditions during the first three years, after which it diminishes but not regularly. The plants may even increase in weight with age owing to the ramification of the stalks and the thickening of the roots. Occasionally the trailing stalks of old plants develop secondary roots.

432 – **The Kudzu Vine (*Pueraria Thunbergiana*), a New Forage Plant in Florida.** — EPPES, E. B. and PLEAS, C. E. in the *Florida Quarterly Bulletin of the Agricultural Department*, Vol. 23, No. 3, pp. 89-101, + 1. Plate. Tallahassee, Florida. July 1913.

This new forage plan shows promise of superseding the velvet bean and of bocoming the most important crop in the Southern States. It is

a deep-rooting trailing perennial and seldom produces seeds. It is propagated by means of plant roots set in rows 8 ½ feet apart each way.

The yield of hay increases as the plant becomes established, from 3 tons in the second year to 6 and even 10 tons per acre on good land. It dries rapidly requiring only 24 to 28 hours, does not shed its leaves and does not appear to be damaged by rain.

Chemical analysis shows that it contains 17.4 per cent. protein and 30.20 per cent. carbohydrate (starch and sugar). Owing to its low percentage of carbohydrate it should be fed with Japanese sugarcane either as silage or chopped into short lengths. It possesses the advantage of being easily eradicated, when necessary, by close grazing in the spring or by breaking up the crowns with a disc plow after cutting in the dry season or during frost in the autumn. When fed to stock it has no tendency to cause intestinal disorders. Moistened with water it makes an excellent green ration for poultry in winter.

433 – **A New Forage Plant, *(Lolium multiflorum).*** — DENAIFFE, M. and COLLE, J. in the *Journal d'Agriculture Pratique*. Vol. I, (New Series), No. 10, pp. 300-302. Paris, March 1914.

Lolium multiflorum is recommended as an excellent catch crop either alone or in combination with *Trifolium incarnatum*. Morphologically it resembles a hybrid between *L. perenne* and *L. italicum*. It grows to a height of 60 cm. to 1 metre and has the general habit of growth of Italian rye grass. Sown on land in "good heat" it produces a crop ready for cutting in from 8 to 10 weeks.

Comparative trials with the three varieties of rye grass on a siliceous clay soil of average fertility gave the following results :

	Yield in lbs per acre		
	L. multiflorus	*L. italicum*	*L. perenne*
Green weight	10 697	11 783	12 210
Dry weight	4 343	2 748	2 748

The yield of *L. multiflorus* obtained at Carignan was much higher, viz. 21 449 lbs per acre of green weight containing 5 058.7 lbs of dry matter. The higher figures for the green weight of *L. italicum* and *L. perenne* obtained at Presle are attributed to the moist weather at harvest and the more tufted habit of these grasses which tends to prevent rapid drying.

A comparison of the chemical composition of these grasses is given in the adjoining table.

The superior feeding qualities of *L. multiflorus* are shown by the figures for cellulose, carbohydrates, and ash. With respect however, to the percentage of albuminoids and fats Italian rye grass is superior.

	L. multiflorum	*L. italicum*	*L. perenne*
Organic constituents % :			
Water	14.30	14.30	14.00
Albuminoids	7.23	9.0	5.30
Amides	2.45	2.20	1.90
Fats	1.40	3.20	1.40
Cellulose	20.50	22.90	23.80
Carbohydrates	44.62	40.60	46.90
Ash	9.00	7.80	6.70
Inorganic constituents % :			
Nitrogen	1.54	1.80	1.10
Phosphoric acid	0.60	0.40	0.36
Potash	1.24	0.75	3.90
Lime	0.80	0.60	1.00

434 – **The Cultivation of Sugar Beets in the Island of S. Miguel in the Azores.** — Molz, E. in *Deutsche Landwirtschaftliche Presse*, Year XXXXI, Nos. 31 and 23, pp. 257-258 and 288-289 + 8 figs. Berlin, March 1914. SUGAR CROPS

The cultivation of sugar beets in the Azores is limited to the island of S. Miguel and has existed there only since 1906. The acreage under beets increased from 719 acres in 1908 to 2964 in 1912. The average crops in the above period was 9.75 tons per acre.

The land is in the possession of only a few owners who rent the land to farmers. The rents vary from £6 per acre in the neighbouhood of the capital to £2 per acre in the interior of the island. The whole crop is worked up by one factory which holds a monopoly from the Portuguese Government and is protected against foreign competition by a customs duty of about $4^3/_4 d$ per lb. of sugar.

For the raising of sugar beets the position is somewhat too far south, but this is compensated by its maritime climate. The porous, stony soil, in which deep ploughing is not often practised, suffers from drought, and without the high degree of atmospheric moisture the growing of beets would be quite impossible. The soil, a product of the weathering of trachytic lava, is poor in lime. Nitrogen and potash are also wanting. The factory has established special regulations as regards manuring, according to which farm yard manure, which elsewhere is considered the principal aid to beet root raising, is limited to a minimum. Green manuring is allowed. The farmers avail themselves of this concession and sow lupins in the autumn which are ploughed in the following March before the beets are sown. The method is not a good one and usually the beets suffer from chronic shortage of plant food.

The factory has also established regulations with regard to the rotation. The fields must be put to beets every third year. But sometimes only

one year's interval is allowed and occasionally the beets are sown year after year. Owing to the high rents the farmers try to get more out of the land by means of intercalary crops, and this again is unfavourable to the beet crop.

The harvest takes place during about the first half of August; it lasts a long time because the numerous fanged roots render cleaning operations more difficult.

Among the many pests to which the beets are subjected the following are especially to be mentioned: *Heterodera radicicola, Heterodera Schachtii, Mamestra brassicae, Agrotis segetum, Blaniulus venustus.* The most dangerous pest of all is, however, *Thyphula betae* Rostr. a fungus which appears especially in dry positions and on flat soils and which damages the beets when they begin to ripen. A black dry rot and damping off fungus also occur.

VARIOUS CROPS

435 – **Bamboos in North Africa.** — Rivière Ch. in *Journal d'Agriculture Tropicale*, Year 14, No 152, pp. 33-38. Paris, February 28, 1914.

The writer gives a study of the bamboos suitable for cultivation on a commercial scale in North Africa.

Group I: Rhizomatous bamboos. — These bamboos vegetate by means of runners in the spring. They never reach great dimensions but are widely distributed.

Three species of *Phyllostachys* are included:

1. *Phyllostachys mitis*, the largest species of the genus.
2. *Ph. viridi laucescens* a species with numerous runners.
3. *Ph. aurea*, growing in tufts.

The compact stems and slow growing rhizomes gives these plants the appearance of a slightly raised hedge or wind break. The stems are straight, rigid and resistant and are suitable for wickerwork and trellises.

Of the *Arundinaceae, Arundinaria Simoni* is robust, produces copious runners and exceeds 6 feet in height. It shows great resistance on almost all soils, owing to its deep, powerful root system. Its stems are suitable for many purposes.

The above species are particularly suitable for fixing moving soils, dunes and exposed subsoil. Their propagation is simple and easy. Division of the rhizomes is carried out in the winter months and water is given 2 or 3 times in the spring.

Group II: Tuftled bamboos. — Growth takes place during summer and autumn and the plants reach greater dimensions than the rhizomatous group. They are of limited distribution in N. Africa since they are very partial to the coastal climate. The most suitable locality is the sea shore adjoining fertile soil, not too compact and in good condition; also subject to watering in the summer.

Three species are cultivated at the present time:

1. *Bambusa macroculmis* (*B. arundinacea*), the largest species in N. Africa. It is ready for cutting after 3 years, and irrigation is absolutely necessary during the warm weather.

2. *Bambusa vulgaris*, smaller and less solid, but more resistant to cold than the preceding.

3. *Bambusa spinosa* (*B. glomerata*), has a wider area of cultivation. Its growth is so dense that it is used for making impenetrable fences, walls of defense, etc.

The writer mentions the precautions necessary when introducing a new species. The necessary watering should be attended to and particular care taken in packing. On arrival at its destination, each plant should be carefully placed in a nursery until a favourable time for transplanting, *i. e.* in mid-winter for the rhizomatous plants and at the beginning of spring for those of tufted habit.

436 – **The Most Important Tannin Yielding Plants of German East Africa.** — Bodenstab Hermann in *Der Tropenpflanzer*, Year 17, Nos. 9-12, pp. 463-481; 529-538; 619-631; 676-690 + 15 diagrams + 8 Figs. Berlin, September-December, 1913.

The writer points out the importance of the imports of tannin matter to Germany (about 300 000 tons valued at about £2 000 000) of which a considerable part comes from the tropics.

Mangroves (1). — The writer omits the mangroves of W. Africa and America and studies the four principal species of the Indian Ocean, *viz.*; *Rhizophora mucronata* Lam., *Bruguiera gymnorrhiza* Lamb., *Ceriops Candolleana* Arn., and *Xylocarpus*. He points out the high value of mangroves for tanning purposes and shows by means of numerous graphs that the proportion of tannin yielded by these plants is approximately the same in all seasons of the year, at any time of the day, at different ages and from different parts of the plant.

The following table gives the percentages of tannin (by the official method) in different samples of bark, calculated on a basis of 14.5 per cent. humidity.

	Minimum	Maximum	Average
Rhizophora / *Bruguiera*	28	42	36
Xylocarpus	27	33	30
Ceriops	24	32	26

The writer has studied the influence of the time of harvest on the quality and in particular on the colour of the hide.

The bark of *Rhizophora* and *Bruguiera* gives as a rule a darker red colour to the hide than that of *Ceriops* and *Xylocarpus*; the latter imparts a yellow colour to the hide which darkens less on exposure to air. The bark of *Rhizophora* and *Bruguiera* harvested at the end of the year yields a lighter product, with a lighter red colour changing to a yellowish brown, instead of reddish brown, on exposure to light. If at all practicable, it would be better to collect the bark of these two species towards the end of the year only. The superior quality obtained at that season may be due to better desiccation. In any case the writer recommends that great care should be taken to obtain a well dried product by working rapidly and avoiding too high temperatures.

(1) See No. 379, *B.* April 1913. (*Ed.*).

The leguminous trees, especially acacias, which produce tannin have also been studied by the writer.

Eucalyptus occidentalis Endl. (Malletrinde). — Occurs abundantly in Western Australia. The bark has been imported into Germany since 1905 and has rapidly conquered the market which now absorbs three quarters of the total production. The tree prefers a clay or sandy clay soil and a climate with a rainfall of from 12 to 20 in, of which 60 per cent. falls during the cold season, and extreme temperatures of 41° and 86° F with an average of 68° F. The commercial product consists of the inner bark containing from 35 to 52 per cent. and an average of 42 per cent. of tannin, the price of tannin being about 3*d* a lb. Tannin is soluble in water at ordinary temperature, forming highly concentrated solutions (up to a strength of 90 to 95 per cent.). The product contains only 7 per cent. of soluble non-tannin constituents, chiefly sugar. It produces hides of good quality and the tree is consequently recommended for planting in the German colonies.

Unripe fruits of *Terminalia Chebula* (Myrobalan chebule) contain 25 to 46 per cent. (mean 32 per cent.) of tannin, the shelled fruits from 45 to 55 per cent. It produces good hides and the writer considers the cultivation of the tree to be a commercial possibility.

437 – The Cultivatión and Commerce of Aniseed (*Illicium verum* Hook). — CHEVALIER, A. in *Journal d'Agriculture tropicale*, Year 14, No. 152, pp. 40-44. Paris, February 28, 1914.

The cultivation of *Illicium verum* is restricted to countries having a very special climate as follows: a rainfall of about 60 inches distributed throughout the year, a sky very often overcast, a high degree of humidity and a temperature varying between 40° C. in summer and 0° C. in winter. The plant grows best in a red argilaceous schist on hill slopes. Planting is done on the quincunx system and the holes are dug 5 to 6 yards apart a considerable time before being required. Shade trees are necessary for the young plants and considerable attention is required until the 8th or 10th year with weeding, watering, hoeing and cutting. Fruiting does not begin until the 10th or even the 15th year and the tree reaches full bearing in about the 20th to 35th year. The yield varies considerably from one year to another and never exceeds 2 tons per acre of green fruit from a plantation in full bearing.

The green fruits are gathered before complete maturity, for the production of aniseed essence. In times of poor harvest the natives make use of the leaves which yield an essence similar to that of the fruits. The variation in the production of aniseed essence at Tonkin is shown by the following figures:

1902	58 tons
1904	32 tons
1911	100 tons
1912	46 tons

The yield was greater in 1913, the value exported being £100 000. It is exported chiefly to Marseilles, Havre and Hamburg.

The essence has been employed for a considerable time in the manufacture of liqueurs and has now found a substantial market amongst manufacturers of perfumery.

438 – **Promising Plant Immigrants in the Philippines.** — WESTER, P. J. in the *Philippine Agricultural Review*, Vol. VII, No. 2, pp. 77-81. Manila, P. I., February 1914. MARKET GARDENING.

The following plants have been successfully introduced into the Philippines and are being distributed.

1. The Lyon Avocado. — Fruit of large size, average weight 800 gm. of which 86 per cent. is edible ; oblong-oval in shape, with thick brittle skin of green colour, separating readily from the flesh ; surface smooth with numerous irregular whitish lenticels ; flesh pale, creamy yellow, tinged with green near the skin, with few fibres ; flavour buttery and nutty ; seed very small, oblong, nearly filling cavity, seed coat readily separating from the flesh; season, late July and early August. The tree is slow in coming to maturity but is able to ripen its fruit in the height of the rainy season.

2. The Cayenne Pine Apple. — Fruit of large size, average weight 3 to 2.75 kilos ; shape oblong slightly conical truncate ; colour browish yellow ; eyes, medium large, not prominent, of medium depth; flesh yellowish, very juicy, rich sweet and slightly acid somewhat fibrous and very aromatic ; flavour and quality excellent; core rather large, inedible ; crown comparatively small. This variety which probably originated in Cayenne French Guiana, is unexcelled for canning purposes and is extensively cultivated in Hawaii and Singapore.

3. The Queen Pine Apple. — Fruit small to medium weight, averaging from 1 to 1.5 kilos ; form oblong, slightly tapering ; colour straw yellow with brown markings ; eyes rather prominent, small and deep; dorsal scale very long and spiny ; flesh yellowish, tender, juicy, sweet, rich, somewhat less aromatic than Cayenne but sweeter ; flavour and quality excellent ; core comparatively small and fairly edible; crown small to medium. The plant is a strong and vigorous grower though dwarfer than Cayenne, and the fruit si somewhat affected by " eye-rot " when it ripens during the rainy season.

4. The India Cucumber. — The fruit is of large size, from 22 to 30 cm. long with an average circumference of 26 cm., and an average weight of 850 gm.; more or less triangulate in section ; colour brown ; surface fairly smooth, cracking on reaching maturity giving it the appearance of being reticulated ; flesh less tender than the standard cucumbers of the temperate zone ; seed abundant. The seed of this variety was obtained from Saharanpur, United Provinces, India. It has shown itself superior to all other cucurbits in resistance to insect pests which practically destroyed other varieties.

439 – **Blooming Periods and Yields of Fruit in Relation to Minimum Temperatures.** — BALLANTYNE A. B. in *Utah Agricultural College Experiment Station, Bulletin*, No. 128, pp. 245-261, + 8 Figs. Logan, Utah, November 1913. FRUIT GROWING.

Experiments have been conducted during several years with peaches, plums and cherries on an area liable to severe frosts. It was found that

the amount of injury to the blossoms was not entirely dependent on the degree of frost, but that other factors such as humidity, rapidity of thawing after freezing, soil moisture and condition of the plant complicated the issue. During the first three years of blooming the damage by frost covers the whole of the crops, and in subsequent years it is sufficient to reduce the yield of most fruits and to entirely prevent some of them reaching maturity, especially almonds, nectarines and some apricots and peaches. Frosts of from 5° to 9° F. when the buds are moist, are less damaging than those of a similar or slightly greater severity when the buds are dry.

440 – **The Kumquat *(Citrus japonica*, Thunberg)**. — Dr. Trabut in *Bulletin agricole de l'Algérie et de la Tunisie*, 20th year, No. 1, pp. 2-11. Algiers, January 1914.

The writer begins by an historical account of the introdution of this plant into N. Africa and America. The Kumquat is a small tree with the foliage of the mandarin, not exceeding 10 feet in height. It blossoms in late summer, producing axillary flowers. The fruits are roundish-oval in shape with a soft skin, sweet, aromatic, and of agreable flavour. The pulp is slightly abundant and faintly acid. The seeds resemble those of the mandarin and the embryo is pistache-green in colour.

The writer describes three distinct varieties :

Ragami, with a characteristic elongated fruit, grown as an ornamental plant.
Maroumi, small fruits, excellent for preserving, very fertile.
Omi Kin-Kan, large round fruits, excellent for preserving and desert.

Propagation. — *Citrus triptera* has been found to be the best stock for extensive culture in Algeria. Unlike other species of *Citrus*, it cannot be grafted at any season of the year, but only at the end of the growing season. Side grafting is very successful and crown grafting is also possible. The " Rough Lemon " or Florida Citrus is used as a stock in Florida.

The Kumquat may be planted 6 × 9 feet or even 6 × 6 ft., *i. e.* 1200 plants per acre. The tree responds readily to good treatment — generous manuring and a sufficient water supply increasing the number, size and quality of the fruits. *Citrus triptera* does not thrive as a stock in calcareous or slightly saline soils.

The Botanical Station has sent several harvests of this fruit to the principal confectioners who have offered to buy all that could be produced. The yield of a good plantation is considerable and regular. Six year old trees will yield from 2 to 6 lbs of fruit. Trees 10 feet high yield about 3 000 to 3500 fruits and at the low price of 5*d* per lb (1 fr. per kilo) one acre will return from £60 to £120.

441 – **Seedless Pomeloes in Siam.** — Boyle H. H. in the *Philippine Agricultural Review*, Vol. III, No. 2, pp. 65-69, + 2 Plates. Manila, P. I. February 1914.

The writer visited a plantation of the famous seedless pomeloes in Siam and found that many of the so-called seedless varieties bore fruits with well developed seeds. More detailed examination of the trees and the precise position of the seeded fruits with respect to neighbouring trees of the " seed " variety showed that the " seedless " varieties are inter-sterile, and that they

only produce seeded fruits on the side nearest to a "seed" variety, the flowers of which are interfertile with those of the "seedless" variety. The Siamese attribute the seedless quality of the fruit to the presence of salt deposited by brackish water from the river in a dry season, and make a practice of placing a coconut shell of salt in each hole at the time of planting the trees.

442 – **The Chemical Composition of Florida Oranges.** — HENNY, A. M. in the *Annual Report of the State Chemist of Florida*, 1913, *Florida Quarterly Bulletin*, Vol. 24 No. 1, pp. 155-204. Tallahassee, Flo., January 1914.

In order to ensure uniformity in the enforcement of the Immature Citrus Fruit Law of 1911, numerous chemical analyses of Florida oranges have been made by standard methods. As a result of some 259 analyses the writer recommends that the mature fruit of *Citrus aurantium* L., the juice of which contains not more than 1.25 per cent. by weight of acid determined as crystallised citric acid be taken as the standard. Determinations of the sugar content do not appear to be necessary and are more difficult to carry out. Details are given of the methods of sampling and conducting the tests in the laboratory and in the field.

443 – **The Budding of Cacao.** — WESTER P. G. in *The Philippine Agricultural Review*, Vol. VII, No. 1, pp. 27-33. + 2 Plates. Manilla, January 1914.

The writer gives an account of former experiments on the budding of *Cacao* and of the results obtained by Hart, Johnson, Harris and Jones. He emphasises the importance of the graft in determining a product of uniform quality. The operation is a simple process, easy and rapid of execution, and its success is almost assured if certain directions are followed.

The stock should be vigorous and at least 15 to 20 cm. in height. The failures of early experiments were due chiefly to the lack of care in the choice of the bud, which should be of the current or previous year's growth. All buds showing attached petioles or unhealed scars should be rejected.

All precautions usually prescribed in budding operations should observed in detail (such as cleanliness, condition of the grafting knife etc.).

The writer recommends the use of cotton bands and of a mixture of beeswax and resin. The cutting of the stock should be begun after about 15 days at a point 10 cm. above the graft. When the graft has grown to a length of 30 cm., the stock may be cut off completely, immediately above the graft. To prevent the attacks of insects and fungi, it is absolutely necessary to cover the wounds with a protective plaster.

444 – **New or Noteworthy Fruits.** — HEDRICK, U. P. in the *New York Agricultural Experiment Station Bulletin* No. 364, pp. 179-195, + 5 Plates. Geneva, N. Y., July 1913.

The writer gives a description with plates of varieties of apples, pears, plums, peaches, cherries, grapes, raspberries, currants, gooseberries and strawberries that have given good results during trials and appear to deserve the attention of fruit growers.

LIVE STOCK AND BREEDING.

HYGIENE

445 – **Investigations into the Life History of the Warble Fly (*Hypoderma bovis*, Geer) and Means of Destroying it** (1). — LUCET, ADRIEN in *Comptes Rendu. Hebdomadaire des Séances de l'Académie des Sciences*, Vol. 158, No. 11, pp. 812-814. Paris, March 16, 1914.

The writer reports upon his investigations into the life history of the warble fly (*Hypoderma bovis*) of cattle, conducted under the auspices of the French Ministry of Agriculture, and which may be summarizes as follows :

1. The migration of the larvae takes place in May, June and July but mostly in the two first months and by preference in the early morning hours. Out of 79 larvae observed, 24 left the hide of the cattle between the 16th and the 24th of May, 53 between the 1st and the 30th of June and only 2 at the beginning of July. In the early part of July the cattle experimented with were always free from the larvae of warbles.

2. The breeding of larvae which have migrated from the hides can be easily carried out either on a protected plot of ground or in the laboratory. In 95 per cent. of the cases observed by the writer the larvae pupated. Every attempt at hastening the migration was always followed by injury during the subsequent development of the larvae.

3. The pupal stage is passed exclusively in the surface of the ground. All the larvae which the writer covered with earth on the advice of German investigators, invariably crept out again into the open before pupating.

4. The pupal stage lasts on average between 30 and 35 days. In 19 cases it lasted: once 29 days, twice 30 days, four times 31 days, four times 32 days, three times 33 days and once each 34, 36, 37, 38, and 40 days. These figures vary considerably from those of Gläser who found that the greatest range in 1912 was from 25 to 63 days and in 1913 from 37 to 56 days.

5. Out of 75 pupae, the writer bred 45 (60 per cent.) completely developed warble flies. Of these, the pupae kept in the open yielded 58 per cent. perfect flies ; those maintained at room temperature yielded 50 per cent. when kept in a pot covered with grass and 89 per cent. when kept in a pot lined with wadding. Pupae in a pot lined with wadding and maintained at 25° C. yielded no perfect flies.

6. Warble flies are exposed to many enemies during the various stages of their development : rodents, birds, insects etc., and are frequently destroyed by lower fungi (*Cephalotecum roseum* etc.) the spores of which exist on the ground and penetrate through te chitinous walls of the pupa.

7. The hatching of the perfect fly only last a few minutes. and is not limited to the early morning but may take place any time during the day.

(1) See No. 144, *B.* Feb. 1913 and No. 251, *B.* March 1914.

446 – **Abortion in Sheep.** — *Journal of the Board of Agriculture*, Vol. XX, No. 10, pp. 879-883. London, January 1914. (Summary of the *III Report of the Departmental Committee on Epizootic Abortion* together with an *Appendix* to the same, Cd. 7156 and 7157. London, 1913).

The President of the Board of Agriculture and Fisheries appointed a Committee in April 1905, to inquire, by means of experimental investigation and otherwise, into the pathology and etiology of Epizootic Abortion, and to consider whether any, and if so, what, preventive and remedial measures might with advantage be adopted with respect to that disease.

In 1909 the Committee submitted a Report (Cd. 4742) embodying the principal results of their investigations concerning Epizootic Abortion as it occurs among bovine animals, and an Appendix by Sir J. McFadyean and Mr. (now Sir) Stewart Stockman, giving a detailed account of the experiments on which the Report was based.

The inquiry was extended to include a consideration of the administrative measures which should be taken to deal with cases of this disease in cattle, and a Report (Cd. 5279) was presented by the Committee in 1910 dealing wih this aspect of the question.

A third Report has now been presented by the Committee, dealing entirely with abortion in sheep, and, in a separately published Appendix, an account is given of the experimental work on the disease in sheep carried out for the Committee by Sir J. McFadyean and Sir Stewart Stockman.

Microbe of Abortion in Sheep. — In the Committee's first Report it was stated that these investigators had never found the microbe of cattle abortion in connection with natural outbreaks of abortion among sheep, and that a totally different microbe — a vibrio — had been repeatedly isolated from outbreaks of abortion in ewes, and that it had been successfully used at the laboratory to infect pregnant ewes with abortion experimentally.

Although the Committee are not prepared to say that the vibrio is responsible for all serious outbreaks of abortion among ewes, they have not met with any other specific form of the disease in this species.

The microbe was found to occur both in the short " S " form as well as in various long spirillar forms. The individual organisms vary in length from 1.5 to 3 microns, and the breadth is from ¼ to ⅓ of a micron at the middle part, which is broader than the extremities. The appearance of the spirillar forms is very like that of a spirochaete. The vibrio is motile.

Virulent Material and its Vehicles. — The contents of the infected uterus, *viz.* the exudate, the membranes and the foetus, contain the microbes and are virulent. An important point is that lambs may be born alive from an infected uterus at or about full time.

In the case of *bovine* abortion an infected cow is probably seldom in a position to infect others until the actual time, or shortly before the actual time of abortion, when virulent material is discharged from the uterus. This however, is not the case with *ovine* abortion. It would appear from the experiments carried out for the Committee that virulent material may be spread about the pastures (*a*) by infected ewes although they may lamb

at full time, (*b*) by aborting ewes, and (*c*) by infected ewes long before they show outward signs of being about to abort.

In connection with the dissemination of the disease among sheep, the Report calls attention to the fact that, as compared with epizootic abortion in cattle, ovine abortion is enzootic in character, that is to say, it seems to confine its operations to a comparatively small proportion of farms without showing much tendency to become widespread. On the other hand, it is pointed out that a disease does not owe its epizootiological character to its contagiousness alone, but also to the opportunities given it for dissemination. The opportunities which operate in relation to the disease in cattle and not in sheep are as follows : — (*a*) Breeding goes on all the year round in the case of cattle, whereas with sheep it is almost entirely confined to a season, and a considerable interval of rest intervenes. (*b*) Cows are frequently sent to the bull on other premises, where the disease may prevail, but this does not apply to ewes to any extent. (*c*) There is a very considerable interchange of in-calf and newly-calved cows through markets, while ewes are practically always tupped on the owners' premises and remain there throughout pregnancy.

The history of some flocks shows that the disease may prevail on the same premises at intervals over a number of years. It is difficult to explain how the virus is kept alive during the long interval between each breeding season ; but bridging this interval it is comprehensible that in those outbreaks which have recurred after an interval of some few years, a few abortions not amounting to an outbreak, may have occurred in the intervening years. The circumstances surrounding some outbreaks favour the idea that the vibrio may lead a saprophytic or other existence outside the bodies of the sheep.

Methods of Infection. — The natural channels of infection are the alimentary and genital passages, mainly the former. The Committee considered whether any part in the spread of ovine abortion is attributable to the ram ; and they state that it seems most improbable that a ram could spread infection mechanically from ewe to ewe in a flock merely from the fact of having been contaminated by an aborting ewe, because, in the great majority of cases, both rams and ewes, when the breeding season begins have been excluded from sexual intercourse for nearly a year, and the ewes must have been free from maternal duties, other than suckling, for about six months. There seems to be only the possibility that a ram from infected premises may be a carrier of infection owing to the upkeep in some way of virus in its body, but of this being actually the case there is no evidence of any consequence.

Symptoms. — No particular symptoms in connection with abortion seem to have been observed in the field except just before the act, when, if the period of pregnancy is advanced, and it usually is, the ligaments are relaxed, the mammae and the vulva are swollen and a sanious, mucoid discharge is seen around the latter. It is pointed out that a pregnant ewe, which before her time shows soiling of the fleece by sanious material, should be regarded with great suspicion, and the discharge should be exam-

mined. The evidence from the field is that many of the foetuses are putrefying when expelled, and this seems to apply more particularly to those which have died in uterus at a comparatively early stage of pregnancy. It appears that the interval between infection and abortion varies between 13 and 113 days, and the percentage of abortions on infected premises averages about 23 per cent. As the result of abortion in ewes, inflammation of the womb is not uncommon, and this may end fatally especially when the contents of the uterus are putrid.

Distribution and Prevalence of the Disease. — Particulars indicating the distribution of the disease were obtained by the Committee by means of replies from farmers to circular letters of inquiry. The proportion of aborting ewes taken by the Committee as indicating that something definite had operated on the ewes was 10 per cent. and over; and of the 476 farmers from whom replies were received the proportion was 10 per cent. and over, on 70 farms (or 14.7 per cent), these infected farms being situated in 24 counties in England, 4 in Wales, and 6 in Scotland. The proportion of barren ewes on the 476 farms was also ascertained, as it was thought that an unduly high proportion might be ascribable to the ewes casting foetuses unobserved. The proportion of barren ewes was 10 per cent. or over in 26 flocks out of the 476.

Preventive and Remedial Measures. — No particular breed of sheep seems to possess natural immunity to the disease, although some individual animals are apparently more resistant to infection that others; and further, the evidence obtained by the Committee as to the resistibility of ewes which had already aborted was in no way conclusive. A few experiments were carried out to ascertain whether immunity could be conferred on ewes by subcutaneous injection of living cultures of the vibrio, but no preventive effects of any value were obtained. Fairly successful results were obtained with an anti-serum, but, owing to doubt as to the constant virulence of artificial cultures of the vibrio, no great importance can be attached to these experiments. Further investigations are proceeding in relation the possibilities of the serum and also as to drug treatment.

To prevent the spread of infection once the disease has broken out the following measures are recommended:

Destruction of Virulent Material and Disinfection of Everything contaminated by it. — This is obviously important. The membranes, foetus, the discharge, and any litter soiled by the material should be removed at once and destroyed. It is even preferable to destroy their virulence on the spot by mixing the material freely with caustic lime and slaking or enveloping it in straw soaked in paraffin and burning it. Any patches of the pen or pasture which are known to have been soiled should be disinfected with a strong disinfectant. The boots, clothing, and hands of attendants should be disinfected.

Isolation of aborting animals and those which have aborted. — When a ewe shows before her time a discharge from her genital organs, or should she abort, it is essential that she should be removed from contact with her fellows. The same applies to ewes which have given birth to live lambs

prematurely, in which case both the ewes and lambs may be excreting infective material. It would be preferable, of course, to remove the still pregnant ewes when this is possible.

Penning or Folding of Ewes before Lambing. — In some cases it is customary to pen ewes at night towards the end of pregnancy, and it is also not unusual to fold them by hurdles to feed on certain crops. As far as abortion is concerned, these practices may do no harm, so long as there are no infected ewes in the flock; but given one or two cases of abortion occuring in the narrow area of a pen or fold, it will be obvious how great will be the opportunity for other ewes to become infected, and it is pointed out that a ewe may abort from infection acquired only a short time before her normal time to lamb. Of the 70 farms referred to above as having experienced 10 per cent. or more of abortion, 46 were in the habit of penning or folding their ewes some time before they were due to lamb.

It is advisable, then, not to adopt these practices if they can be avoided but if they are adopted the greatest vigilance should be exercised in watching for cases of abortion. Should such occur, two courses are open either to destroy all evacuated material, disinfect the ground, and remove the ewe, or immediately to remove the other ewes to clean ground. The second course is the more to be recommended, if it can be carried out.

Disinfection of the Genital Passages of Ewes which have aborted. — This may be done by gently injecting an antiseptic wash (3 per cent. pure carbolic acid in water, or corrosive sublimate 1 in 2 000) by way of the external genital organs. It is advisable to carry out this treatment, because it may have the effect of destroying a certain amount of virulent material which has passed from the uterus into the vagina, and it may also help to prevent further invasion of the passages and womb by harmful microbes from without. Ewes which have aborted should be put in improvised pens, and treated in the same way until the discharge ceases.

ANATOMY AND PHYSIOLOGY.

447 – **The Problem of Early Maturity in Breeding from the Biological Point of View.** – MÜLLER, R. in *Deutsche Landwirtschaftliche Tierzucht*, Year 18, No. 1, pp. 2-5. Hanover, January 2, 1914.

From the breeder's point of view, early maturity does not necessarily signify early sexual maturity, but only accelerated growth. Investigations have shown that this growth is influenced by the internal secretory glands (thymus, thyroid, pituitary, etc.) which are complementary organs to the sexual glands. It follows that the sexual glands also must be an important factor in growth. As a proof of this the writer mentions a fact he observed in some of his experiments, namely that unilateral castration caused changes in the growth of the skeleton. The early development of the sexual cells must naturally first affect the sexual characters. Independently of this influence, the development of the sexual characters depends also upon the energy of growth belonging to the corresponding part of the body.

Early maturity is not, as SANSON assumed, exclusively dependent upon nutrition, which is its principal determining factor, but is also influenced

to a great extent by the specific nature of the animal, *i. e.* by the activity of its internal secretory glands.

Changes in the form of the organs of digestion and principally the increase of their weight or volume cannot be considered as certain signs of early maturity. It seems in fact that, in this respect, there is no difference betwen early and late maturing animals. On the other hand the connection between the physiological activity of the digestive organs and early maturity is certain.

On the development of the teeth early maturity seems to act in various ways. The temporary teeth are not much influenced by it while the permanent ones are to a greater extent. The individual teeth also behave differently : the incisors in early maturing animals develop before the molars and the first incisors grow more rapidly than those near the molars. Among the domestic animals cattle especially are liable to a premature appearance of the permanent dentition. Normally the permanent teeth are all up at the age of three years, but early maturity can shorten this period to two years. According to CORNEVIN the premature change of teeth can take place in three ways: 1) by the premature fall of the first incisors; 2) by the loss of the first incisors at the normal time followed by the loss of the other incisors at rapid intervals; 3) by the more or less simultaneous loss of all four incisors. The growth of the permanent teeth varies considerably with the degree of early maturity of the animals and CORNEVIN has distinguished three degrees as follows :

	1st degree of early maturity		2nd degree of early maturity		3rd degree of early maturity	
	Cattle	Sheep	Cattle	Sheep	Cattle	Sheep
	months	months	months	months	months	months
Change of 1st incisors	14–15	12	18	14	19–20	16
» 2nd »	18	16	24	18	28–30	20
» 3rd »	24	19	28–30	24	35–37	27
» 4th »	29–31	26	37–39	32	40–45	26

In the early maturing breeds of pigs the early appearance of the milk teeth can be observed. The early change of teeth is however not so noticeable as in ruminants.

Horses have not yet been sufficiently studied in this respect; cases of early development of teeth have been observed, but they appear to be rare.

The influence of early maturity on the conformation of the body and especially on the formation of the skeleton is connected with the effect of selection and of environment. Early maturity resulting from better feeding in favourable environment generally leads to increase in the size of the body and to a shortening of the limbs.

The system of management under which the animals are kept has a great influence on the early maturity of the muscles and internal organs. According to BAUDEMENT breeds which can be forced by high feeding have less voluminous and consequently lighter lungs. SEEBERGER always found heavier hungs and hearts in the late maturing sheep of Franconia than in the early maturing Southdowns. Similar differences have been observed amongst draught horses.

The skin, hair and horns become finer in early maturing animals, but this influence may be counteracted by other conditions such as climate.

With regard to the question whether early maturity and great fecundity may occur together, the writer states that the early maturity of the sexual organs and that of body in general may be independent of each other as is proved by the great fecundity and remarkable genetic power of many early maturing animals. In the same way a high milk yield and early maturity may be found in the same animal (Bate's strain of shorthorns). The combination of high milk yield and early maturity requires well developed and active sexual glands.

Whether early maturity shortens the life of the animal and the period of certain physiological functions (duration of pregnancy, of sexual life, etc.) has not yet been fully ascertained. It would seem that the duration of pregnancy is somewhat diminished by it.

FEEDS AND FEEDING

448 – **Studies on Phytin.** — ANDERSON, R. J. (New York Experiment Station) in *The Journal of Biological Chemistry*, Vol XVII, No. 2 pp. 141-190. Baltimore, March 1914.

The organic phosphoric acid isolated by the writer from cottonseed meal (1), on more detailed examination of the barium salts and of the free acid, proved to have a formula which did not correspond exactly to the one usually attributed to phytic acid, but rather to that of inosite hexaphosphate. The same phosphorus compound was isolated from oats and from maize, and finally from commercial phytin, so that it would appear that the organic phosphoric acid known as phytic acid is either inosite hexa-phosphate or an isomer of the same.

BREEDING,

449 – **Multiple Factors in Mendelian Inheritance.** — MACDOWELL, E. C. (Bussey Institution) in *The Journal of Experimental Zoology*, Vol. XVI, No. 2, pp. 177-193. Philadelphia, Pa., February 20, 1914.

A small male rabbit of the Himalayan breed was crossed with a series of females belonging to a larger race, and the F_1 females resulting from this cross were also mated with their original small parent. The bones of the rabbits when full grown were measured in sixteen different ways, and from the data thus obtained the *coefficient of size* for each individual was calculated as follows: the mean of each character for a fraternity was divided by the value of that character for a single individual and the average of the quotients for all the characters gave the coefficient of size for any one animal.

(1) See No. 257, *B.* March, 1914.

In order to compare the variability in the F_1 generation with that of the second cross, the animals were classified according to their coefficients of size and the standard deviation of the different classes was estimated. The data was also treated in order to show the relationship between the parents and each set of offspring considering only one character at the time; and, lastly, the variability of the body weights was compared. The results all point to the fact that there was greater variability in the second cross than in the F_1 generation, indicating the presence of multiple Mendelian factors.

450 – **Budget of the Prussian State Studs for 1914.** — GENIESER, E. in *Deutsche Tageszeitung*, No. 134, 3rd supplement. Berlin, March 14, 1914. HORSES.

The budget of the Prussian State studs for 1914 gives the following data on the present conditions of the studs in Prussia :

There are 5 principal and 18 provincial studs which are stocked as follows :

38 stallion, 2730 brood mares, 480 young stock — for the five principal studs : Graditz, Trakehnen, Beberbeck, Neustadt (Dosse) and Georgenburg.

and 3645 provincial stallions in the 18 provincial studs :

Rastenburg, East Prussia	with	181	stallions
Braunsberg, » »	»	190	»
Georgenburg, » »	»	235	»
Gutwallen, » »	»	235	»
Marienwerder, West »	»	176	»
Pr. Stargard, »	»	165	»
Neustadt-Dosse, Brandenburg	»	227	»
Labes, Pomerania	»	175	»
Zerke, Posen	»	200	»
Gnesen, »	»	236	»
Lenbus, Lower Silesia	»	185	»
Cosel, Upper »	»	210	»
Kreuz, Pr. Saxony	»	150	»
Travensthal, Schleswig-Holstein	»	130	»
Celle, Hanover	»	400	»
Warendorf, Westphalia	»	192	»
Dillenburg, Nassau	»	152	»
Wickerath, Rhine province	»	206	»
Total		3645	

The total number of horses of both sexes including thoroughbreds, half breds and heavy draught animals is 6943.

For the upkeep of the studs the following sums are estimated ;

Ordinary expenses	£558 462
Ordinary income	255 037
Difference	303 425
Extraordinary expenses	52 459
Total outlay	£355 884

or £45 901 more than the State had provided for 1913. The ordinary expenses include the following items: salaries, management, feeding, expenses for racing at Graditz (£19 600) and purchase of horses (£118 090).

On the other hand the ordinary income is made up as follows:

Sale of horses at principal studs	£ 36 224
» » » » provincial »	9 666
Service fees and sale of foals	149 078
Produce from land and farms	26 197
Sundries	33 823
	£254 988

Among the extraordinary expenses there are £14 700 for exceptional purchases of horses, and £17 650 as a provisional instalment for the purchase of land intended for a State stud for thoroughbred horses at Altenfeld in the Cassel district. The rest of the extraordinary expenses is almost exclusively devoted to new buildings and enlargement of old ones at the existing stud farms.

Of the 3645 stallions of the provincial studs 2845 are thoroughbreds and half breds and 800 are heavy draught horses. To keep up the stock 341 thoroughbreds and half breds (12 per cent.) and 120 heavy horses (15 per cent.) are required per annum. Of the 341 thoroughbred and half bred stallions required for 1914, 95 will be supplied by the principal state studs, so that only 246 stallions will have to be bought, namely 20 thoroughbreds and 226 half breds. All the 120 heavy draught stallions will have to be bought as the Prussian State does not breed them. The price paid for half bred and heavy draught stallions in former years has been on an average about £206. In 1914 their average price is estimated at £245. For the 20 thoroughbred stallions the estimate is £735 each.

In the budget for 1914 a sum of £9800 is set apart an as instalment for the bi-annual purchase of a first class thoroughbred stallion worth £19 600. Besides this, two good thoroughbred stallions worth £5880 together are also to be purchased. As in preceding years two thoroughbred mares will be purchased for the thoroughbred stud of Graditz at an average price of £1470.

In order to meet the demands of the increased armaments voted in the autumn of 1913, the studs have increased the number of their stallions by 55 in eight studs; the number of brood mares has been increased at Neustadt from 60 to 70. The extraordinary expense caused by these increases amounts to £14 700.

CATTLE

451 – **The Limits of Error in Milking Tests at Intervals of One and Four Weeks.** – MARTINY, B. in *Arbeiten der Deutschen Landwirtschafts gesellschaft*, Part 254, pp. 27-32. Berlin, February 1914.

During a five weeks trial of Sharples' milking machine conducted at the Wrechen Estate, Mecklemburg Strelitz, on 20 black and white lowland

cows, total yields obtained were compared with those calculated from weekly tests (1). The results are tabulated in the adjoining table :

Differences between actual milk yields and those calculated from weekly tests.

Cow	actual yield during the 4 weeks in kilog.		Maximum differences									
			in Kilog.				per cent.					
			Milk		Fat		Milk			Fat		
	Milk	Fat	+	—	+	—	+	—	together	+	—	together
1. . . .	353.6	9.55	6.5	13.1	0.31	0.25	1.8	3.7	5.5	3.2	0.7	3.9
2. . . .	454.4	14.32	23.4	10.0	0.85	0.52	5.1	2.2	7.3	5.9	3.6	9.5
3. . . .	329.0	10.49	9.8	9.8	0.32	0.58	3.0	3.0	6.0	3.1	5.5	8.6
4. . . .	343.2	12.02	4.3	24.3	0.44	0.57	1.2	7.1	8.3	3.7	4.7	8.4
5. . . .	418.2	13.16	6.3	8.3	0.50	0.73	1.5	2.0	3.5	3.8	5.5	9.3
6. . . .	478.5	13.57	9.5	5.3	0.39	0.58	2.0	1.1	3.1	2.9	4.3	7.2
7. . . .	456.9	11.68	10.1	12.8	0.47	0.62	2.2	2.8	5.0	4,0	5.3	9.3
8. . . .	451.5	14.03	12.7	9.4	0.78	0.70	2.8	2.1	4.9	5.6	5.0	10.6
9. . . .	356.1	10.55	9.6	13.9	0.20	0.11	2.7	3.9	6.6	1.9	1.4	3.3
10. . . .	399.7	11.02	7.7	7.4	0.43	0.18	1.0	1.0	2.0	3.9	1.6	5.5
11. . . .	315.9	8.63	8.6	7.1	0.67	0.40	2.7	2.2	4.9	7.8	4.7	12.5
12. . . .	333.0	10.27	12.5	5.4	0.84	0.58	3.7	1.6	5.3	8.2	5.6	13.8
13. . . .	393.9	12.55	12.5	15.9	0.58	0.31	3.2	4.0	7.2	4.6	2.5	7.1
14. . . .	343.1	10.88	4.9	2.6	0.32	0.24	1.4	0.8	2.2	2.9	2.2	3.1
15. . . .	331.3	10.21	8.3	15.8	0.49	0.38	2.5	4.8	7.3	4.8	3.7	8.5
16. . . .	384.9	12.66	11.9	14.2	0.89	0.98	3.1	3.7	6.8	7.0	7.7	14.7
17. . . .	261.3	8.52	4.9	5.8	0.24	0.20	1.9	2.2	4.1	2.8	2.3	5.1
18. . . .	334.8	10.30	9.6	15.1	0.56	0.61	2.9	4.5	7.4	5.4	9.5	14.9
19. . . .	283.4	6.71	6.6	5.3	0.11	0.26	2.3	1.9	4.2	1.3	3.0	4.3
20. . . .	265.6	8.60	5.7	6.6	0.47	0.28	2.1	2.5	4.6	5.5	3.3	8.8
lowest	261.3	8.52	4.3	2.6	0.11	0.11	1.0	0.8	2.0	1.3	0.7	3.1
highest	478.5	14.32	23.4	24.3	0.89	0.98	5.1	7.1	8.3	7.0	9.5	14.9
average	360.4	11.09	9.27	10.4	0.49	0.45	2.5	2.8	5.3	4.4	4.1	8.4

Differences between the two sets of results are already considerable when the tests are made once a week (maximum for milk $\pm$ 4.15 per cent., for fat $\pm$ 7.45 per cent.) and it may be assumed that if the interval

(1) Cfr. *Arbeiten der Deutschen Landwirtschafts gesellschaft*, part 211, pp. 25-32. Berlin 1912.

between tests were extended to two or three weeks the differences would still be greater. Sampling once in four weeks gave the following differences:

Milk, average difference . . .	± 10.7	per cent
Fat » » . . .	± 16.4	»
Milk, maximum difference . .	± 17.1	»
Fat » » . .	± 27.05	»

The total yield and the fat content of milk are thus subject to such considerable variations that weekly milking tests are barely sufficient to determine large differences in the milk yielding power of individual cows in herds possessing but little unformity; in more uniform herds neither fortnightly nor weekly milking tests are sufficiently reliable. Especially where a very high standard of production is required, success is out of the question unless the the milk yield of every cow is determined daily.

POULTRY.

452 – **Twelve Months Poultry Laying Competition.** — RHODES F. W. in *Report of the Harper Adams Agricultural College* pp. 1-49. Newport, Salop, 1913.

The competition took place at the Harper Adams Agricultural College Newport, Salop, and lasted from October 15, 1912 to October 14, 1913.

A hundred pens, of six birds each, took part in the competition and the following breeds were represented:—

Ancona	4 pens
White Leghorn	18 »
Black Leghorn	3 »
Croad Langshan	3 »
White Wyandotte	33 »
Black Wyandotte	1 »
Silver Laced Wyandotte	1 »
Black La Bresse	3 »
Buff Orpington	13 »
White Orpington	1 »
Buff Rock	7 »
Barred Rock	1 »
Salmon Faverolle	2 »
Rhode Island Red	7 »
Red Sussex	1 »
Silver Campine	1 »
Black Minorca	1 »
	100 pens

Trap nests were used exclusively and the eggs, were graded into three classes according as their weight was above 2 oz., between 1 ½ and 2 oz., or below 1 ½ oz.

The winning pen consisted of white wyandottes with an average record of 231.5 eggs per bird (the average record of all birds in the competion being 151.9 eggs per bird), and the breed generally was most successful, taking five out of the six best positions in the competition. Medium sized birds proved better layers than the heavier birds of each breed and the average score of the birds which laid ten eggs during the

first month was 187.5 while the average of those which did not begin to lay till after the second or third month was 135.8 and 106.3 respectively (1).

The birds received two meals per day — a feed of mixed grain in the morning and a warm mash in the afternoon, as they flourished better under this system of management than when the order of the meals was reversed. The cost of the food worked out at 1.8*d.* per head per week or 0.6*d.* per egg produced. About 75 per cent. of the eggs could be graded in the class above 2 oz. in weight while only a negligeable number were in the class below 1 ½ oz. in weight.

453 – **Some Physiological Observations Regarding Plumage Pattern.** — PEARL, R. and BORING, A. M. (Papers from the Biological Laboratory of the Maine Agricultural Station, No. 60) in *Science*. Vol. XXXIX, No. 995, pp. 143-144. New York, January 23, 1914.

A study of the successive regeneration of feathers, carried out by tattooing a circle with india ink round each follicle selected for observation. The investigation has lasted for eighteen months and the present paper, which is a provisional report, records, the following facts:

Feather follicles will not reproduce feathers indefinitely between moults. Usually the body feathers are reproduced three times but the number of regenerations varies both with the bird and with the kind of feather, being largest on the wing primaries.

A follicle made quiescent by successive removals of the feather will, however, again become active after a general moult.

The pattern of the feather is usually faithfully reproduced in the new feathers, but when feather production is forced by removal of the feather as soon as it is fully grown, the pattern tends to be gradually broken up. Finally the secondary sexual feathers of the males are produced from follicles which originally bear undifferentiated body feathers, and if the latter be removed before the natural moult, the secondary sexual feathers will be developed prematurely.

454 – **The Odour of the Flesh of the Coot.** — BLAHA, SIGISMUND in *Hoppe-Seyler's Zeitschrift für Physiologische Chemie*, Vol. 89, Part. 6, pp. 456-464. Berlin, March 17, 1914.

As the result of numerous analyses of fats the writer comes to the conclusion that the disagreable odour of the flesh of the coot (*Fulica atra*) is due more especially to the presence of monomethylamine.

455 – **The Silk Industry in Japan during the Reign of the Late Emperor Meiji.** — HONDA J. in *Bulletin de l'Association Sericicole du Japon*, Year 1, No. 4, pp. 8-10. Tokio, December 1, 1913. SILKWORMS.

Agriculture in Japan during the reign of the late emperor Meiji is distinguished by the great development of sericulture, due, to a great extent, to the personal support of the monarch. This is especially evident in the comparison made in Table I between the values of the exports of the first years of that emperor's reign (1867) with these of 1890, the year follow-

(1) See No. 363, *B.* April 1914.

ing the proclamation of the constitution, and with those of 1911, the year which preceded his death.

TABLE I.

Year	Raw Silk £(1)	Silkworms' eggs £	Other products £	Total £
1867	625 347	371 225	39 859	1 036 431
1890	1 385 934	844	293 701	1 680 479
1911	12 703 335	0	945 528	13 648 853

(1) 1 yen is taken as = 2*s* (*Ed.*).

From the above it appears that Japan exported considerable quantities of silkworms' eggs during the first years of the emperor's reign, that this exportation gradually diminished while that of raw silk increased. The latter rose constantly from 1875, and in 1911 it was 19 times greater than it had been in 1867.

The increase of the production of silk and of the area planted to mulberries is shown in Table II in which the figures for 1878, 1890 and 1911 are compared.

TABLE II.

Year	Acreage under mulberries acres	Production		
		Raw Silk lbs	Cocoons bushels	Silkworms'eggs packets
1878	531 703	2 991 508	4 642 214	1 387 139
1890	547 558	7 781 994	5 775 667	2 295 004
1911	1 099 342	26 585 815	20 950 100	8 188 041

The values of the products of sericulture exported during the reign of the late emperor are grouped together in Table III.

TABLE III.

Years	Value of the products			
	Raw Silk £	Silkworms'eggs £	Other products £	Total £
1867–1889.	30 717 637	2 132 445	770 157	33 620 239
1890–1911.	164 769 960	2 290	53 706 744	218 478 994
Total . . .	195 487 597	2 134 735	54 476 901	252 099 233

While Japan was inferior to Italy and China as a producer of silk in 1867, she overtook and passed Italy in 1871, and China in 1902, and is now the greatest producer of silk in the world.

456 – **Comparison Between Silk Cocoons Produced by Feeding the Worms on Standard or Dwarf Mulberry Leaves.** — NAKAMURA M. M. in *Bulletin de l'Association Séricicole au Japon*, Year 1, No. 3, pp. 6-7. Tokio, November and December 1913.

Some silkworms of a Japanese breed (Aojuku) and some of a French breed (Var) were fed on leaves taken from standard mulberry trees. Other worms of the same breeds were fed on leaves from dwarf mulberries. The cocoons that were produced from both lots of worms were compared in order to ascertain if the form given to the tree has any effect on the quality of the cocoons produced. The results may be grouped as follows :

1. The length and resistance of the thread of the cocoons produced by the worms fed on dwarf mulberries were greater than those of the lots fed on standards.

2. The total nitrogen content of the cocoons was approximately the same in both lots. The content of monoamino acids was greater in the lot fed on dwarf mulberry leaves.

3. In ash content a difference was noted only in the Japanese breed, the standards fed lot giving higher values. The lime and potash content of the ash was also greater in the standard fed lot. The phosphorus content was the same in both lots.

4. The solubility in water of the dry matter seemed to be the same for both lots ; but the specific gravity of the cocoons produced by the standard fed worms was greater than that of the other lot.

5. The weight of the reeled silk obtained from the standard fed lots was always inferior to that from the dwarf fed lots.

FARM ENGINEERING.

457 – **Mechanical Tillage Experiments at Grignon, France.** PILLAUD H. in *La Technique Moderne*, Year 6, 1st half-year, No. 1, pp. 21-25, January, 1914.

AGRICULTURAL MACHINERY AND IMPLEMENTS

The experiments on mechanical tillage organised by the French Ministry of Agriculture on the estate of the Grignon Agricultural College meet a long-felt want of farmers and agricultural machine builders.

In the absence of comparative tests, farmers have not yet decided which types of machines are best adapted to the various farm operations. Information is required as to the amount, quality and cost of the work of the various machines and on the services other than tillage that they can render. In America some important competitions have been held, especially at Winnipeg, which have supplied precise data, but most of them refer to machines unknown in France and to other conditions of farming.

In Europe there have been several tests and competitions, among which the best known are those of Prague, Vienna, Breslau and recently at Chassart. In France and Northern Africa, among others, the trials carried out at Creil,

Chaumont-en-Vienne, Bourges, Algiers, and Tunis have yielded data on the work of several outfits and on its cost per acre.

Unfortunately the means available for these tests have generally been insufficient and it is with the object of obtaining very complete results that the French Ministry of Agriculture has organized these experiments at Grignon which were commenced in October 1913, and are to be continued for some years. In doing so the Ministry developed the plan of the Société des Agriculteurs de France in the trials organised by them at Puiseaux, enlarging its scope and including in the undertaking the agricultural associations most interested in motoculture, such as the above mentioned Association, the Société Nationale d'Agriculture de France, the Société Nationale d'Encouragement à l'Agriculture, the Automobile Club de France and the Comité Francais de Culture Mécanique.

The programme provides for the following test:

Cultural experiments.

1. *Obligatory tests.* The competing machines must perform two winter ploughings for sugar beets to a depth of between 10 and 14 inches, in one of which farmyard manure is to be ploughed in; one winter ploughing after wheat to a depth of between 8 and 10 inches; and a fourth as light as as possible (4 inches deep at most) after beets, ploughing in the leaves.

2. *Optional tests.* A winter ploughing to a depth of 14 inches with subsoiling from 4 to 8 inches; a winter ploughing 10 to 14 inches deep, at the same time ploughing in a catch crop; breaking up of grass leys and trials for scuffling, harrowing, rolling, cultivating and harvesting.

In each plot one portion is cultivated in the customary fashion to allow of comparisons being made between the results of team and mechanical work both of which are carried out at the same time and under the same conditions.

Mechanical experiments.

Besides the cultural experiments, which are the most important as they show the practical value of each machine, these are also submitted to scientific examination bearing on the following points: study of the motor and of the transmissions; mechanical experiments in the field as to the power of each machine; its consumption when working at various depths etc; and cultural experiments in order to determine the agricultural value of the different work compared with that effected by the usual means.

Only French builders or representatives of foreign firms entering machines built in France are admitted; some foreign machines have however been authorized to enter for the competition but without being entitled to indemnities or prizes.

The following twelve outfits are taking part in the trials :

A. French machines:

Tractors : Edmond Lefebvre.
Outfits with windlasses and cables : A. Bajac and Doizy.
Tractors hauling on a cable: G. Filtz.
Motor ploughs and hoes: Banche, Benedetti and Dubois.
Special systems with rotary diggers: Derguesse Tourand, Le Motoculteur Co., Vermond-Quellenec.

B. Foreign Machines:

Tractors: International Agricultural Machine Co.
Motor ploughs: Stock.

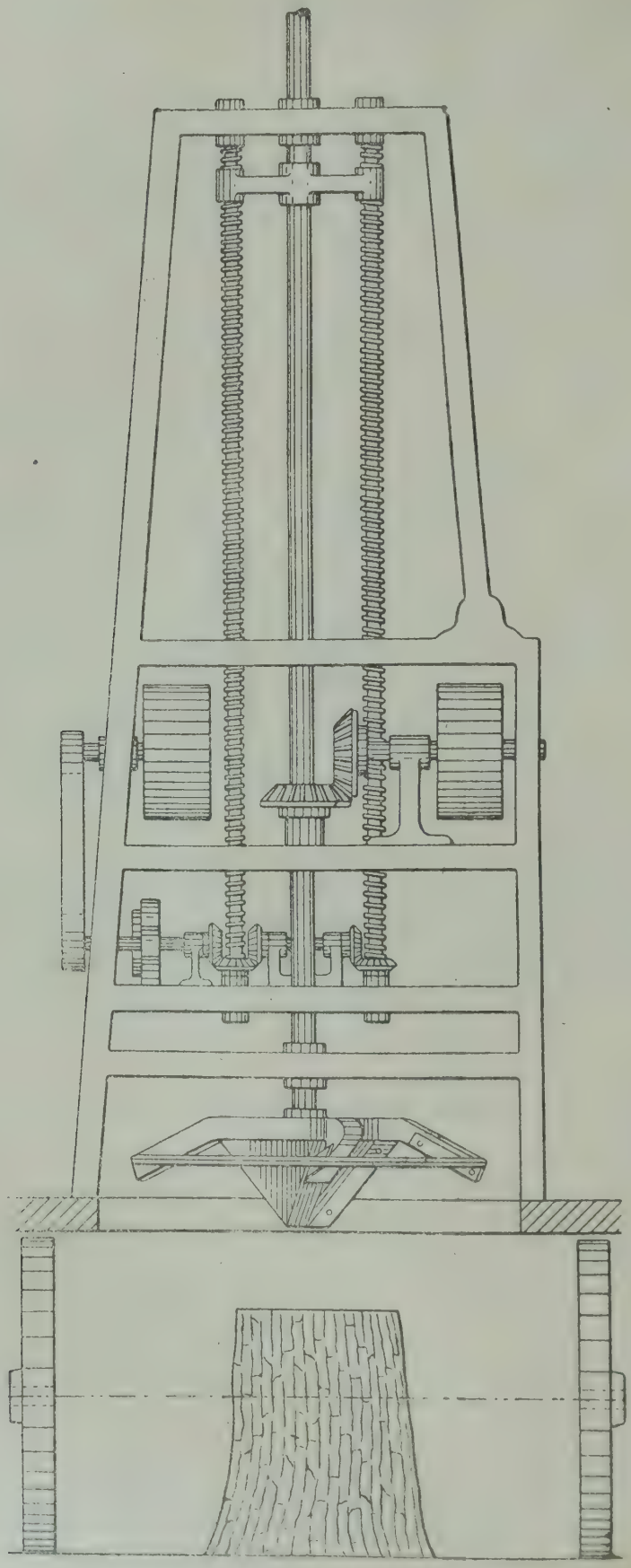
458 – **Stump-Cutting Machine.** — *Engineering Record,* Vol. 69, No. 10, p. 146. New York, March 7, 1914.

A machine for cutting down stumps 6 in. and more in diameter has been devised and patented by A. L. and G. D. Moore of New Orleans. The machine is shown in the accompanying sketch; it is strongly built and can be attached to any tractor. In working it is propelled to the stump and the cutter head is made to revolve at 400 revolutions per minute. The cutter head is lowered by a friction feed operated by a rocking lever. The thickness of the chips or shavings is regulated by the feed screws.

The cutter can be regulated so as to penetrate 18 inches below the surface of the ground, if necessary, so as to consume all the stump, leaving only the minor roots.

The cutter head is so formed that, with the velocity of working, the chips are thrown upwards by a centrifugal motion. The chips are guided by a hood or jacket and are blown in one direction so that they can be sacked or carted away. The principal object of the machine is to clear cut-over lands from stumps, leaving the land ready for cultivation. At the same time the stumps are cut into small chips which can be used for the manufacture of by-products such as wood pulp.

It is worked by two men and the cost of the oil fuel is estimated at $3 per day of 10 hours.



Stump-Cutting machine

459. – **Trial of Sharples' Milking Machinery**. — MARTINY, B. *Arbeiten der Deutschen Landwirtschafts Gesellschaft*, Part 254, pp. 53 with figs. Berlin 1914.

The milking machinery built by Sharples according to Macartney's invention consists of a vacuum apparatus, a set of air pipes, a pulsator and a can connected with four teat cups by rubber pipes. The can is patented in Germany under No. 260 631.

The *vacuum apparatus* is composed of two suction and force air pumps mounted on the same frame, of a driving pulley and of two air reservoirs of unequal size, the larger one being for the rarefied air and the smaller one for the compressed air.

The *air pipes* are common gas pipes, one inch in diameter for the rarefied air, and half an inch for the compressed air. They are suspended from the ceiling of the stable by a hanger between every two cows, which supports also the pulsator and the connection between it and the pipes. Each of the latter is also provided with a manometer (see Fig. 1, in which *a* are the over head pipes, *b* the pulsator, *c* the milk can and *d* the teat cups).

The *pulsator*, which is fully described and illustrated in the paper, makes from 45 to 55 double oscillations per minute; the motion is irregular, and lasts longer during suction than during compression. It sends compressed and rarefied air alternately to the teat cups. The rapidity of the pulsations can be regulated, within certain limits.

The *milk can* has the shape of a truncated cone, is made of tinned steel and stands 15 inches high without its lid. Its capacity is about 3 gallons. A small piece of glass is let in near the lid through which the inflow of the milk can be watched. The lid is of solid tinned brass casting and can be fixed to the can and made airtight by means of rubber rings. It bears a handle with two hooks, on one of which the teat cups may be hung for convenience in carrying, while the other can be used for suspending the lid and cups on to the air pipes when the can is being changed. There are, besides, on the lid a relief valve and a cock, the former to prevent the milk from getting into the air pipes when the can is too full and the latter to allow the milk from the teat cups to flow into the can.

In the lid, two tubes are fastened, one leads from the relief valve to the pulsator and conveys the rarefied air to the can, the other connects the central cavity of the rubber cylinder within the teat cups to the can. Through the handle on the lid a long pipe is passed which connects the pulsator with the space between the rubber cylinder and the outer steel cylinder within the teat cups (see Fig. 2).

The *teat cups* (shown in Fig. 2, *a* when milking begins and *b* when it ends) consist of hollow tinned steel cylinders slightly funnel shape at the top. They are 5.31 inches long. The cylindrical part is 1.55 inch in diameter, the top 1.67 inch. Within each steel cylinder there is a rubber cylinder 0.14 inch thick, and 1.10 inch in inner diameter, which receives the teat. Between the rubber and the steel cylinders there is a space of 0.15 inch into which compressed and rarefied air is driven alternately. Suction inside the rubber cylinder causes it to adhere firmly against the udder and draws

the milk out while the upper part of the rubber cylinder exerts an intermittent pressure on the teat by changes of pressure in the space outside the cylinder.

The complete milking outfit with pipes and pulsator weighs 26.3 lbs,

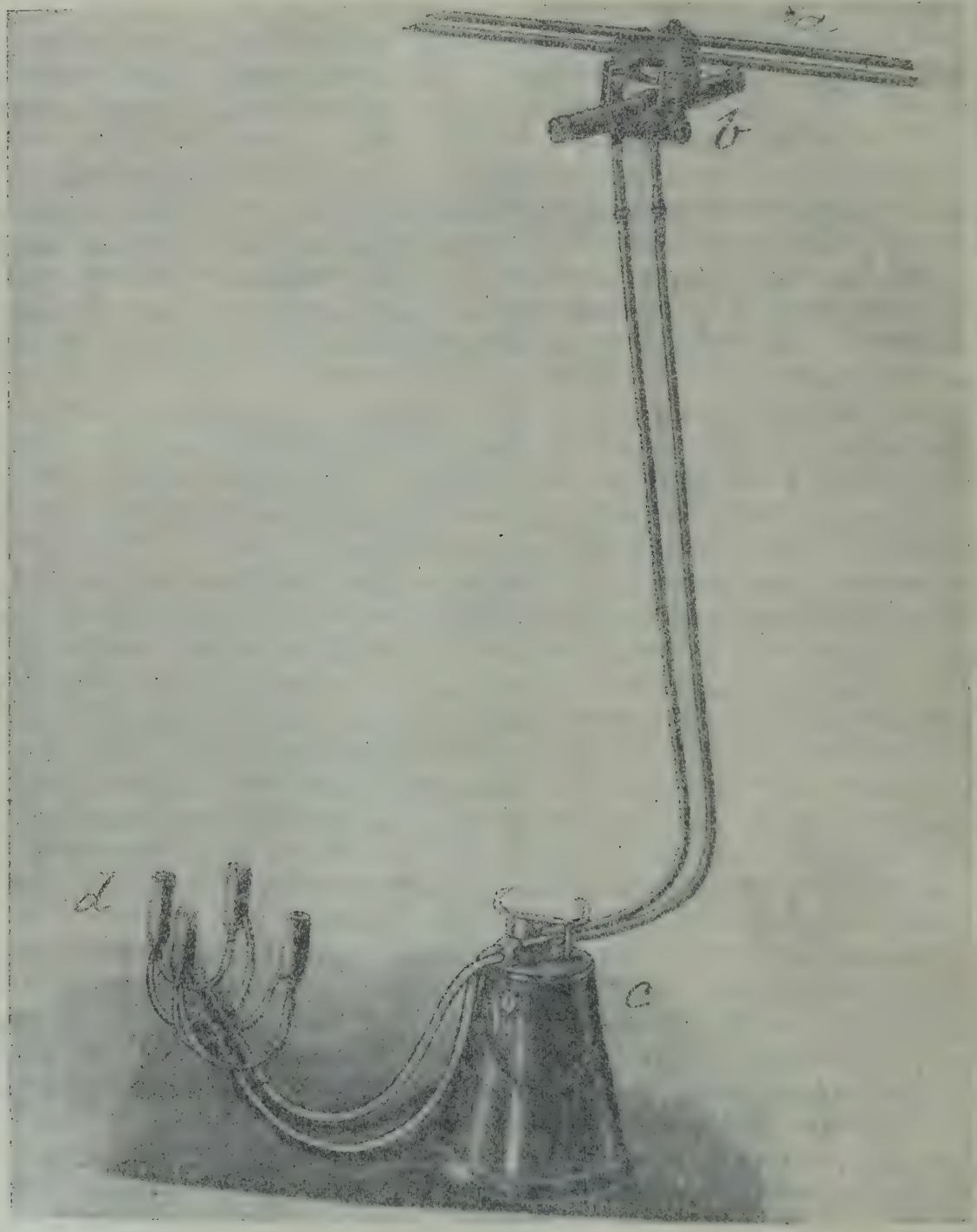


Fig. 1. — Sharples' milking machine.

the milk can without the lid 7.7 lbs and the lid alone 5.5 lbs. A teat cup with the rubber cylinder but without the pipes weighs 0.66 lbs. The weight o the 4 teat cups and tubes as they are borne by the cow weigh about 4.4 lbs.

Cost of milking plant. — The pumping apparatus sufficient for 500 cows costs about £24.10s. The overhead pipes for 25 cows about £1.14s and each milking set £22. The cost of a machine milking plant depends chiefly upon the number of milking sets required. Assuming that for every 25 cows to be milked in 1 ¼ to 1 ½ hours two milking sets are necessary, and that a 2 HP electromotor costs about £22 and a 3 HP benzol motor about £49, the whole plant complete would cost :

			£	s	d		£	s	d	
for	25	cows. . . . from	3	18	9	to	4	15	1	per cow.
»	50	» . . . »	2	15	3	»	3	6	0	»
»	75	» . . . »	2	9	1	»	2	16	4	»
»	100	» . . . »	2	6	0	»	2	11	4	»

This apparatus is very costly for small dairies. Of course the cost diminishes if the pumps can be driven by existing power machinery or by horse or bullock gears or when the motors can be used for other work besides milking.

Trial of endurance. — These milking machines were used for some time on 80 cows at Herr SEIP'S estate at Wrechen, Mecklemburg Strelitz, the work being done by two men with three machines each followed by a woman stripping by hand. The power was produced by an 84 HP electromotor which, however, also drove a chaff cutter, a pump and an oil cake crusher.

In the same estate in June and July 1913 a trial of endurance of the plant was made on 20 cows weighing on average 990 lbs. each which were milked by one man with three machines. The same man did the stripping by hand also. The quantities of milk obtained by the machine and by stripping were carefully weighed and measured and examined for fat content and specific gravity. The food given to the cows during the same time was weighed and recorded. The following points were also investigated :

1. *The behaviour of the cows towards machine milking.* — During the whole time the experiment lasted, none of the cows showed any objection to being milked by the machine, not even those heifers which were not easy to milk by hand.

2. *State of health of the cows.* — While the general health was good throughout, the udder was positively benefited by the gentle intermittent pressure on the teats as a substitute for the rougher treatment of hand milking.

3. *The quantity and quality of the milk* did not seem in any way to be affected by machine milking.

4. *The time employed in milking.*—Twenty cows were milked by one man with three machines morning and evening. Each milking, including stripping, took on average 59.1 minutes, thus one cow was milked by one machine in approximately 9 minutes. The total quantity milked daily averaged 578.38 lbs or 289.14 lbs per milking. Consequently 1 machine would have milked 100 lbs in 61.3 minutes or 97.68 lbs per hour from cows yielding an average of 28.93 lbs per day.

The results were somewhat different with the other 60 cows of the herd. When milked by 2 men with 6 machines and a woman for the stripping, one machine milked 82.06 lbs of milk per hour from cows yielding 15.4 lbs per day besides which the woman employed 41.6 minutes for stripping 14.47 lbs of milk. The difference in the performance of the machines is chiefly due to the greater quantity of milk yielded by the 20 cows. The time employed in milking by machine depends on how far the machine is allowed to complete its work. It is not advisable to let the machine milk

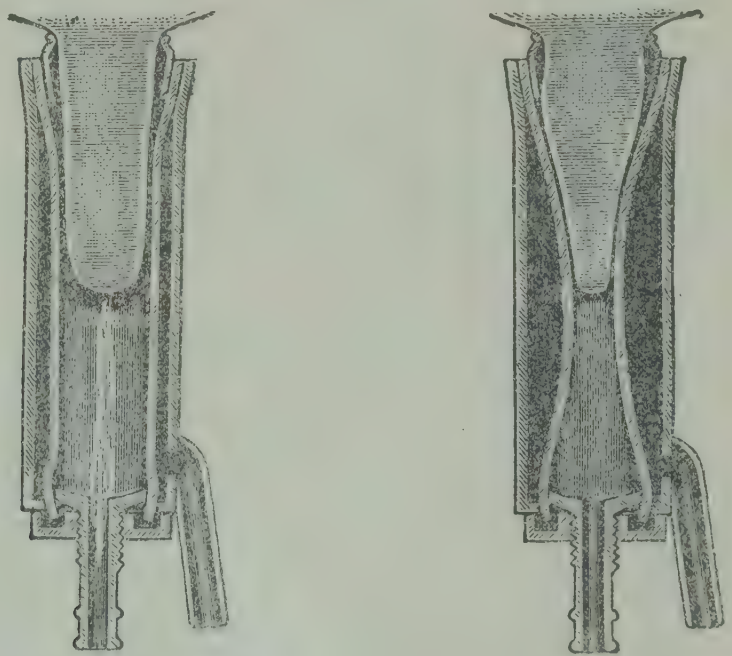


Fig. 2. — Teat cup:
a) When milking begins
b) when milking ends.

a cow dry because in the first place the milk flows so slowly towards the end that it is stripped quicker by hand, and in the second place stripping by hand is necessary to ascertain the state of health of the udder.

Besides actual milking, the time required for cleansing all the parts that come into contact with the milk has to be considered. At Wrechen the daily rinsing of the three machines took only 3 minutes and the weekly cleansing with soda averaged 23 minutes. Between one milking and the next the rubber pipes were kept in lime water. The writers however consider the above cleansing to be somewhat too hastly and inadequate.

Motor power required. — At Wrechen an 8 HP electromotor was used. When 80 cows were milked with 6 machines, at each milking an average of 742 lbs of milk were obtained in 82 $\frac{1}{2}$ minutes and, approximately 5 kw. were used, or for 100 lbs of milk 0.67 kw. But as the above motor drove the shafts and pulleys for other farm machinery it is estimated that an average of 2.75 kw. would be sufficient or 0.36 kw. per 100 lbs of milk.

Depreciation of plant. — As this plant has been in use only about a year no conclusion can yet be drawn as to its durability; still with careful handling one tenth of the cost per annum ought to be ample to cover wear and tear.

Cost of machine milking. — The cost of the milking plant for 80 cows, in working order may be estimated at £186. Calculating the yearly interest and wear and tear at 15 per cent. or £2718 *s.*

the share of this item for each milking is		9.18*d*
the labour of two machine milkers for 1½ hours per milking at 3.53*d* per hour		10.59 »
the labour of one hand stripper, 1½ hours at 5.88*d* per hour		8.82 »
the daily, weekly and monthly cleansing of the machine per milking		0.47 »
electric power 2.75 kw. at at 3.53*d* per kw. hour . . .		9.65 »
lubricants and sundries		0.47 »
Total . . .	3*s*	3.18*d*

Thus 1485 lbs of milk from 80 cows obtained in two milkings cost 2 × 3*s* 3.18*d* = 6*s* 6.36*d*.

or the cost of machine milking 100 lbs of milk is . . . 3.27*d*

and » » » » 1 cow 0.98*d*

Comparing the above with the cost of milking by hand, labour being paid 3.53*d* per hour, the former is 15 per cent. dearer.

Conclusions. — 1. That from the technical point of view Sharples' machine gives very satisfactory results.

2. That Sharples' milking machines are not economically advisable for a herd of less than fifty cows unless a cheap source of power is available.

3. That the current opinion that any farm hand is capable of milking with a milking machine is erroneous. On the contrary it requires an intelligent, careful and conscientions worker who is not only a good stockman bat also a good mechanic.

4. That stripping by hand is always necessary, not only to ensure thorough milking but also because it allows the immediate detection of anything wrong with the udders.

5. That in order to avoid interruptions in the working, the plant must be frequently examined and duplicates of the essential parts kept in reserve.

6. That cleaner milk can be obtained by machine milking, provided all the parts coming in contact with the milk be carefully cleansed every time they are used and the stable be kept scrupulously clean, for which the Dutch system is especially suitable (1).

That for the trial of a milking machine never less than twenty cows should be employed.

(1) See, Prize essay of the German Dairy Association on the Dutch stabling system, *Schriften des Deutschen Milchwirtschaftlichen Vereins*, No. 34. Leipzig, 1908.

8. That the special features of Sharples' milking machine are not only "new and remarkable" but deserve special recognition and the award of the large silver medal.

460 – **A New Milking Machine.** — LUCAS. J. E. in *Journal d'Agriculture Pratique*, Year 78, Vol. 1, No. 10. Paris, March 5, 1913.

The Alfven milking machine is a pressure milker. The pressure is exerted between a metal plate and some rubber fingers which work like the fingers of the human hand. There are four sets of fingers with their respective plates (in order to be able to milk the four teats at the same time) fixed on one frame and mounted radially to a central axis.

The counterplates (E, fig. 2) are double walled; the nearer wall is fixed during milking, and forms with the second wall a firm spring which

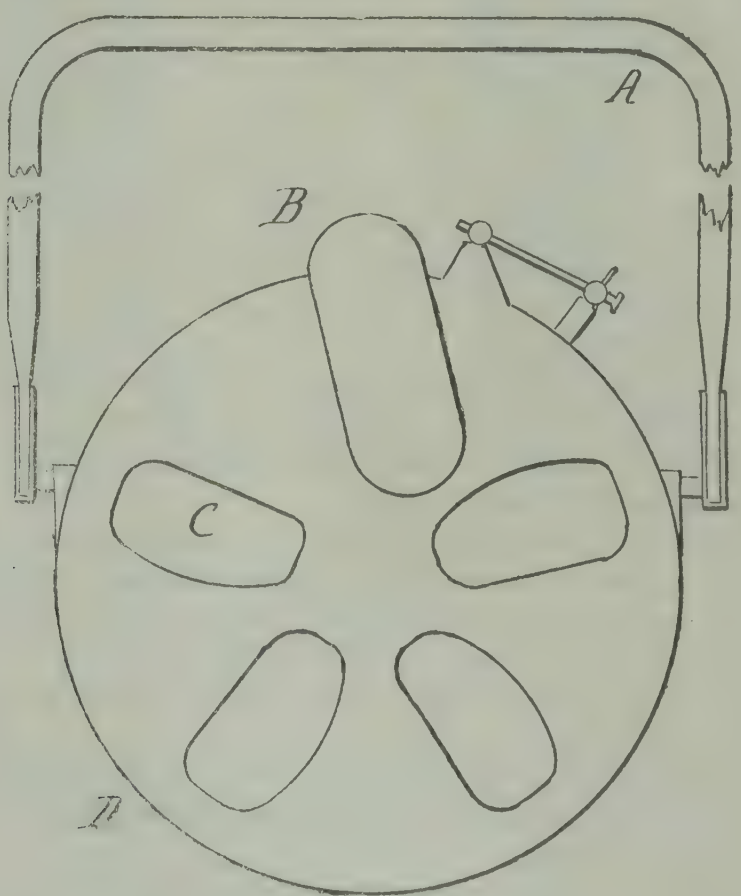


Fig. 1. — Alfven milking machine.

is sufficiently flexible however to press against the teat without injuring it in any way.

The sets of four fingers are arranged crosswise (see fig. 2, V) round a central axis and are moved by a set of cams which act on metal loops, T, fixed to the fingers and mounted on a fifth radial piece of the apparatus.

Six series of such crosses are placed one above the other. The cams are arranged so as to press each of the crosses in succession against the teat. The first series presses against the base of the teat, then successively the

second and the third. When the fourth begins to act the first begins to open ; it is the same with the fifth and the second and the sixth and the third.

Thus continuing the pressure on the teat, the apparatus allows the milk to begin to flow again in the upper part of the same teat. A special compensating device allows the milker to be easily adjusted by one single screw to the different sizes of the teats.

The whole apparatus is covered by a metal plate (D, fig. 1) with four openings over the spaces between the fingers and the counterplate.

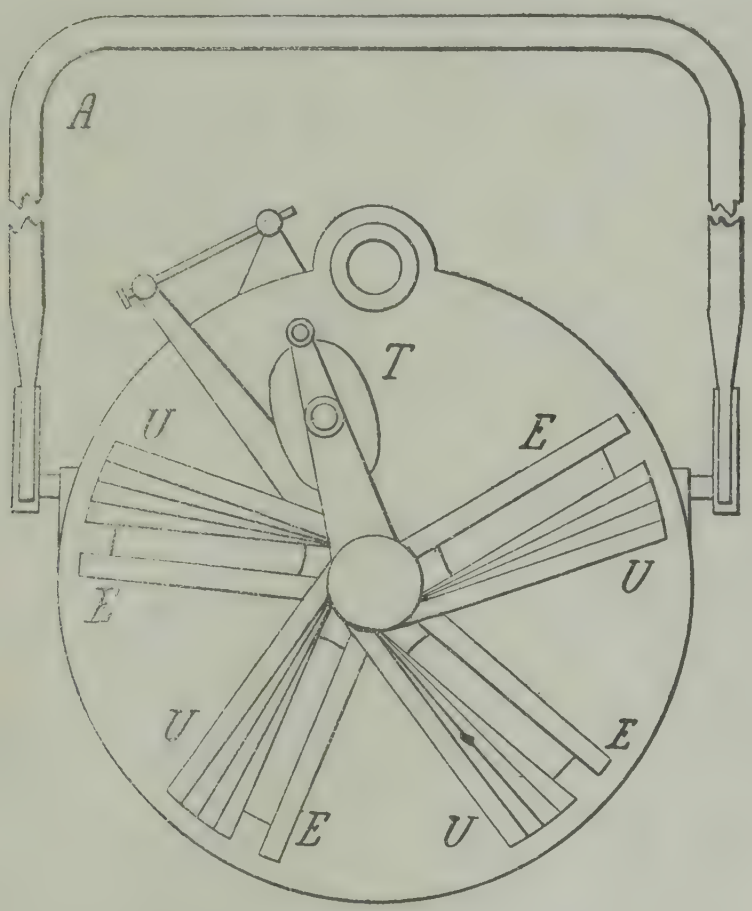


Fig. 2. — Alfven milking machine.

When it is required not to milk one of the quarters the corresponding aperture may be blocked by means of a suitably shaped small piece of wood.

The milker is suspended by a double belt over the cow's back. In front of the milker a spring handle (A, fig. 1 and 2) presses against the abdomen of the cow and keeps the milker in position over a funnel and milk pail.

The whole milker weighs about 22 lbs. It is worked by a small dynamo (B, fig. 1) attached to it and which requires the same electric power as a lamp of about 16 candle-power. The machine can be easily and quickly dismounted and cleaned.

Experiments with the above milker were carried out during 40 days on several lots of cows and no ill effects were noticed either with regard to the general health of the cows or the udders. On an average the machine drew 98 per cent. of the total milk and the amount obtained did not differ by 1 per cent. from the amount obtained from the control lot. The time employed in milking by hand was 5 minutes 20 seconds and with the Alfven milker 5 minutes 45 seconds; but one man can control three machines. Calculating the duration of the machine at 10 years, the yearly cost of milking a herd of 60 cows would be £188 with the milker, and £208 by hand.

461 – **Agricultural Machines Exempted from Customs Duties in Peru.** — *Landwirtschaftliche Maschinen und Geräte*, Year 14, No. 12, p. 41. Artern, March 1914.

The Government of Peru has published a decree according to which machines and parts of machines for the use of agriculture are admitted into the country duty free.

BUILDING CONSTRUCTION.

462 – **Fireproofing of Wood.** — *Engineering Record*, Vol. 69, N. 6, pp. 172-173. New York, February 7, 1914.

The question of fire proofing wood was included in the investigations of the Forest Products Laboratory at Madison, Wisconsin, U. S. A. in 1912.

A preliminary report was presented by ROBERT E. PRICE at the recent convention of the American Wood Preservers' Association of which the following is a summary:

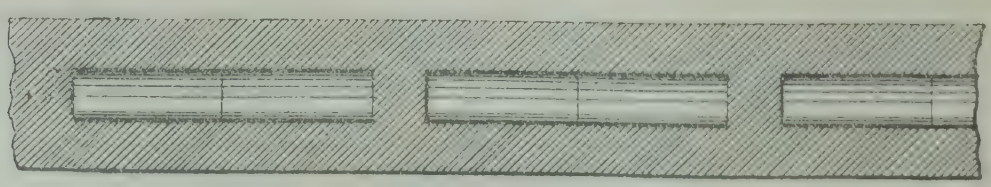
1. Ammonium salts are of considerable value in fireproofing wood. It was impossible to ignite wood, under the test conditions, that had been treated with these salts.

2. Borax is of considerable value in fireproofing wood. It has not the value of the ammonium salts, but promises a means of lessening the cost of treatment by using it with another salt of greater value.

3. From the good results already obtained it appears possible to devise a reasonably inexpensive method of rendering wood fire-retarding.

463 – **Cheap Stable Walls.** — *Schweizerische Landwirtschaftliche Zeitschrift*, Xear XLII, part 7, p. 157. Zürich, February 13, 1914.

Recently stables have been built with hollow walls of cement or bricks. Where gravel is cheap concrete walls will be found very economical. For the



hollow spaces rejected drain pipes can be used; they can be bought very cheaply at brick and tile kilns.

In building the drain pipes into the concrete walls to it is important to to tie the inner and outer surfaces every two or three lengths by leaving out the drain pipe and letting about 4 inches of concrete run right across.

Such walls have been built only 12 inches thick and their inner surfaces remain perfectly dry even in the coldest weather, while solid sandstone walls, 28 inches thick, get so cold as to condense moisture on their inner surface.

Fig. 1 shows a horizontal section of a 12 inch wall with 4 inch pipes built in.

464 – **Feeding Box for Poultry.** — *Technische Monatshefte*, Part 3, pp. 102-103. Stuttgart, March 7, 1914.

The feeding box shown in the accompanying figures keeps the food dry and clean and prevents its being stolen by sparrows or mice. When a fowl steps on the hinged board placed under the box, its weight causes the trap door in the lower part of the box to open and the food comes out as fast as it is consumed. When the fowl has eaten enough and goes away the counterweight closes the trap door immediately. The weight of a lighter animal such as a sparrow or a mouse is not enough to open the trap door.

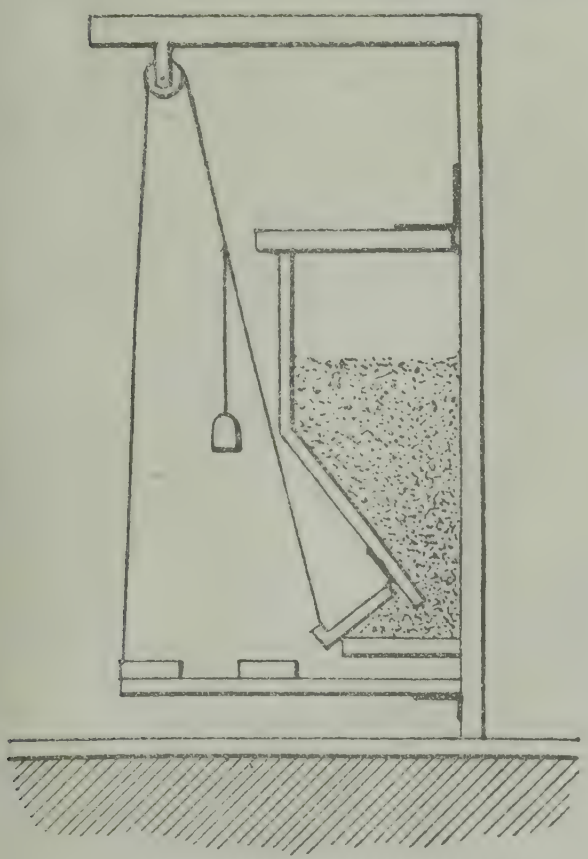


Fig. 1. — Feeding box for poultry. Trap door closed by counterweight.

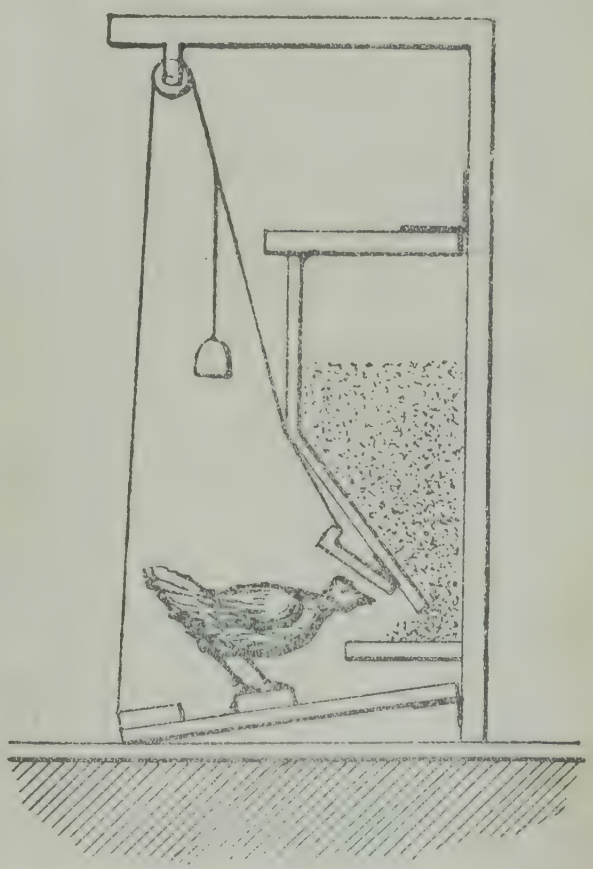


Fig. 2. — Feeding box for poultry. Trap door opened by weight of fowl.

RURAL ECONOMICS.

465 – **Influence of the Distance from the Market on Farming in Fifty Moravian Farms.** — MARESCH, H. in *Oesterreichische Agrarzeitung*, Year V, N. 7, pp. 76-89. Vienna, March 7, 1914.

The writer divides the 50 farms under investigation into three groups, the first contains those farms situated within a three mile radius from the

market, the second those between the three and six mile radius and the third those beyond the six mile radius. He then enumerates the possibilities of marketing the vegetable and animal products in these groups, describes the economic conditions of the farms and their labour requirements, both manual and horse, and proceeds to estimate the influence of the distance from markets upon the whole management of the farms.

Distance from markets exerts a great influence on the utilization of the land as is shown by table I:

TABLE I.

Distance from market	Percentage of cultivated acreage				Distribution of total acreage	
	Fields	Gardens	Meadows	Pastures	Cultivated area	Wood
	%	%	%	%	%	%
0 to 3 miles	75	4.1	19	1.9	93.7	6.3
3 to 6 »	82	2.0	13	3.0	86.6	13.4
more than 6 miles. .	63	0.2	29	7.8	69.9	30.1

The relative acreage of cultivated land diminishes with the increase of distance from the market, and still more rapidly does the relative acreage of the gardens decrease, for the carriage of fruit and vegetables is a very difficult matter for small farms. The area in meadow land depends less upon distance than upon soil and water conditions, though their extension in the last group is at least partially due to distance. Pasture and woods increase with distance.

The distribution of capital in the three groups is as follows (Table II):

TABLE II.

Distance from market	Capital invested in: land		buildings		dead stock		live stock		crops		total	Working capital	
	per acre of cultivated area	per cent of total capital	per acre of cultivated area	per cent of total capital	per acre of cultivated area	per cent of total capital	per acre of cultivated area	per cent of total capital	per acre of cultivated area	per cent of total capital	per acre of cultivated area	per acre of cultivated area	per cent of total capital
	£ s d		£ s d		£ s d		£ s d		£ s d		£ s d	£ s d	
0 to 3 miles .	31 2 4	58.9	11 18 6	22.7	2 18 0	5.4	5 18 7	11.2	1 0 7	1.8	52 16 6	4 1 0	13.
3 to 6 miles .	22 16 7	59.1	8 5 3	21.4	1 18 2	4.4	4 14 9	12.7	18 11	2.4	38 13 6	4 18 10	13.1
more than 6 miles. . . .	15 7 9	44.4	11 5 4	29.9	2 18 4	7.7	6 5 10	16.7	9 5	1.3	35 3 0 5	4 7	23

The value of the land diminishes considerably with the distance from the market while the value of buildings do not appear to be influenced dir-

ectly. Distance from markets has a more visible effect upon the capital invested in crops, for fruit trees are not planted to any great extent at a distance from markets — the capital invested in fruit trees is between 4*s* 6*d* to 9*s* 9*d* per acre up to the six mile radius, and beyond, only 1*s* 8*d*. The capital invested in live stock is also notably affected: from £6 5*s* 10*d* in the first group it sinks to £4 14*s* 9*d* in the second and rises again in the third to £6 5*s* 10*d*; of these sums the value of draught animals is £1 4*s* 3*d* per acre or 20 per cent. in the first group and £1 9*s* 4*d* or 31 per cent. and £1 4*s* 5*d* or 27 per cent. in the second and third. The capital invested in draught animals thus increases regularly with the distance, while the value of the productive stock which is £4 13*s* 9*d* per acre in the first group sinks in the second to £3 5*s* 5*d* and rises again in the third to £4 11*s* 5*d* owing to the greater production of fodder in distant farms.

The amount of dead stock diminishes from the first to the second group by about one third as, with the less intensive style of farming, machines are not so largely used. At distances beyond six miles the necessity of transport material is more felt and causes an increase of the dead stock. The working capital increases with the distance from the market; this is due to the fact that much of the grain is fed to young live stock, thus retarding the turnover of the capital.

The influence of distance on the labour required in the three groups is shown by the following table which gives the number of available days' work per acre of cultivated area:

0 to 3 miles	51 man days	18 horse days
3 to 6 »	43 » »	15 » »
more than 6 miles.	39 » »	23 » »

The draught animals diminish with the increased distance from their market owing to the less intensive style of farming and to the lower number of brood mares kept. At greater distances more horses are required on account of the increased transport The number of man days diminishes regularly with the increase of distance owing to the decrease of hoed crops and of cereals and the increase of forage plants and pulse.

The proportion of the various crops on the cultivated land is the following:

	up to 3 miles %	beyond 3 miles %
Winter cereals	33.3	23
Spring »	33.3	33
Clover.	16.7	22
Hoed crops	16.2	11
Pulse.	—	11

As for live stock, the raising of young animals increases with distance: the live weight of young animals is 54.4 lbs per acre of cultivated land in the first group, 56.2 in the second and 75.8 in the third. On the other hand the breeding of foals diminishes as the distance increases and ceases altogether at six miles, the live weight of foals being only 6.2 lbs per acre of

cultivated land up to three miles, 4.5 lbs up to six miles and nil beyond six miles.

Table III gives a summary of the variations of the live stock per acre of the cultivated area according to the distance from the market :

TABLE III.

Distance from market	Live weight of total live stock lbs.	Percentage of		Live weight of eattle		Percentage			Live weight of pigs		Live weight of small animals, mostly poultry	
		Stock for draught purposes	Other stock	lbs	Per cent of total live stock	Steers	Cows	Calves	lbs	Per cent of total live stock	lbs	Per cent of total live stock
0 to 3 miles . .	332	17	83	245	74	5	79.5	15.5	23	6	3.12	1
3 to 6 miles. . .	305	18.3	81.7	205	67	5	76	19	17.8	7	1.34	3
more than 6 miles	327	23	77	239	73	5	64	31	10.7	3.8	1.34	0.2

The number of draught animals increases with the distance from the market and that of productive animals diminishes. The number of steers is not influenced by distance, while the number of cows diminishes and the breeding of young animals increases. Pig-keeping diminishes with the distance both absolutely and relatively to the live weight of the total live stock. Poultry also diminishes with the increase of distance.

Table IV shows the effect of distance upon the value of the agricultural produce marketed per acre of cultivated land :

TABLE IV.

Distance from market	Total value	Consisting of:				Value of the animal products							
		plant products		animal products		Cattle		Horses		Pigs		Poultry	
	£ s d	£ s d	per cent	£ s d	per cent	£ s d	per cent	£ s d	per cent	£ s d	per cent	£ s d	per cent
0 to 3 miles .	4 4 8	1 0 11	24.1	3 3 9	75.9	2 15 2	87.8	2 8	3	4 11	7.7	1 0	1.5
3 to 6 miles. .	3 19 7	18 11	24.5	3 0 9	75.5	2 9 7	80.8	1 3	2	8 7	14.2	1 1[illegible]	3.0
more than 6 miles	1 8 1	5 7	11.0	1 13 7	89.0	1 7 5	82.8	—	—	5 8	17.2	—	—

The receipts per acre of the farms diminish with the increase of the distance from the market, the relative importance of live stock increases, while the absolute value of the animal products diminishes as does that of the vegetable products. By far the greatest proportion of live stock consists of cattle ; the sale of foals is relatively low.

The receipts from pig raising increase with the distance while those from poultry keeping increase at first and then cease altogether at a distance of six miles.

406 – **Types of Agricultural Holdings in Northern Tripoli.** — From the « *Relazione della Commissione per lo studio agrologico della Tripolitania* ». Rome, Ministero delle Colonie, 1913.

The various systems of cultivation existing in Northern Tripoli give rise to different forms of holdings which may be grouped into three main classes :

1. *Irrigated holding or garden* (Sánia) ;
2. *Enclosed mixed plantation* (Genán) ;
3. *Plantions of various sizes.*

1. The *Garden* may be looked upon as the constituent element of the oasis, and is the type of holding where irrigated crops are grown together with certain trees such as palms. It possesses certain characteristics :

a) is hardly ever isolated, but usually forms part of a nucleus of cultivated land (oasis) ;

b) is enclosed and independant, though in the poorer and less well cultivated regions, it frequently has a right of way across it ;

c) is provided with its own well for irrigation purposes which does not prevent the use of natural overflow after rain or of dry land methods of cultivation where such are suitable ;

d) constitutes in all cases a well defined estate unit.

2. The *Enclosed mixed plantation* differs from the garden both technically and economically. The enclosed portion alone hardly ever constitutes a separate estate unit, but is almost always only part of a holding. In other words there is normally adjoining the enclosed plantation a piece of land of varying size which is used for grazing and for growing cereals. This land, further, is frequently used as "*mésga*" (irrigable land) because in many cases the holding is situated in an undulating district and gets the benefit of the natural overflow after rain. The holding too is almost always isolated never forming part of an oasis. This form of holding, thus consisting of two parts, one for grazing and cereals and the other an enclosed plantation, possesses certain technical characteristics as follows:

a) The enclosure round the inner part of the holding is necessary to exclude the live stock which graze in the outer portion, and usually consists of low *tábia* on the top of which are planted live or dead spinous plants, principally *Calicotoma intermedia*. Prickly pear are no longer used for this purpose as the crops on the inside are less delicate and consequently no longer require such an efficient wind break ; occasionally prickly pears are used as a hedge, grown espalier fashion just inside the enclosure and against the *tábia*, or they may be replaced even in this position by fennel.

b) The boundary of the whole holding is usually marked by a line of *Scilla maritima*, or by low earthern banks, or by long stones set up vertically in the soil.

c) Plantations of trees other than palms are characteristic of dry soils, palms being only found in the moister positions or as isolated specimens. Olives more especially, and figs, vines, almonds and carobs, are the most usual plants with apricots, pomegranates and pears in the more favoured localities.

d) Trees are planted very thickly in the moister positions.

e) Where more intensive culture is carried out herbaceous plants are excluded or reduced to a few vegetables. In the less fertile tracts barley is grown in the bare patches between the trees.

f) Usually there is no living house on the holding, especially if the latter is at all near to a residential centre. Where the living house exists on the holding, it is always situated on the external grazing land, but the more usual thing is for cultivators to camp out on their holding during the tillage and harvest season.

g) Sometimes caves are dug out to afford protection to man and beast from both storms and burning sunshine. Such caves are rare in the Homs district, rather more frequent in Gefara, Mselláta and Tarhuna, and normal in the Jebel Garián.

h) Usually there is no well, but as the land is undulating, there is generally a cistern by the side of which is placed the oil extracting mill; only on the more important estates do they use presses for this purpose, the presses in this case being set up in caves.

j) The size of these holdings is very variable; mixed plantations under intensive culture usually only run to a few hundred square yards; olive groves and vineyards are usually larger, extending on an average to about 1 ½ acres; holdings of Europeans in the neighbourhood of Homs are much larger still, varying from 12 ½ to 17 acres, while those on the Steppe of the Mescia of Tripoli will even attain 75 acres in extent.

3. *Plantations* are chiefly found in hilly districts such as Mselláta and Garián, and possess the following characteristics:

a) Their size runs into a few score of acres, being usually larger in M'sell than in Garián.

b) They usually consist of olives and figs generally underplanted with barley.

c) The trees are usually planted in rows at wide distances apart so that underplanting may be practised.

d) The plantations are used for pasturing live stock unless they consist of pure fig plantations, consequently they are not enclosed and boundaries are marked by lines of *Scilla* or by earthern banks.

e) The holdings have no well, cistern, or living house.

f) They have no apparatus for oil extraction on the spot, the olives being taken to the villages to be crushed.

The cost of establishing holdings of type 1 and 2 is estimated below. The figures refer to a non-native cultivator and are only very approximate:

1. *Irrigated holding* (1.5 *hectares*).

	lire	lire	lire
I. *Value of land* (300 lire p. ha)			450
II. *Improvements:*			
1. Sinking well (13 yds. deep)	600		
2. Irrigation canals	400		
3. Pumping machinery	600		
		1 600	
4. Fencing or enclosing		750	
5. Buildings		2 500	
6. Tillage (80 day's work)		120	
7. Planting:			
175 palms	450		
45 citrus trees	170		
36 apricots	100		
36 mulberry and other fruit trees	75		
		795	
			5 763
III. *Working capital.*			
1. Live stock:			
4 working cows	900		
2 pack arnimals	600		
		1 500	
2. Dead stock		350	
3. Furnishing the house		300	
4. Running expenses, seeds, manure etc.		500	
			2 650
			2 650
Total			8 865

2. *Enclosed mixed plantation.*

Two examples are given of this type of holding, one on a thin and rather arid steppe soil which represents poor but not the worst conditions, and one a relatively fertile and moist soil representing more favourable conditions. In the second case it would be possible to cultivate intercalary crops and to raise cattle on the holding over and above the main plantation crops while in the first case this would not be possible. In both cases each holding should accomodate three families of agriculturists, other labour required being provided by natives.

Example A. — *On a thin Steppe* (200 *hectares*).

1. *Distribution of surface.*

	ha.
Olives	60
Vines	[illegible]
Figs	[illegible]
Almonds	[illegible]
Prickly pear and others	35
Fallow	60
Barley	60
Buildings, roads etc.	1.5
	200.0

2. *Distribution of capital:*

	lire	lire
Price of land (50 lire per ha.)		10 000
Living houses		9 000
Buildings		14 000
Wells, sinking etc.		1 800
Roads		1 000
Plantations:		
Vines, expenses for four years	1 300	
Olives (compensated by barley crop)		
Figs » » » »		
Almonds » » » »		
Prickly pear and others	700	
		2 000
20 Working animals		6 400
Dead stock, including oil extraction apparatus		12 720
Working capital:		
Food for stock	5 500	
Depreciation and repairs	1 200	
Seeds	1 000	
Labour	6 300	
General expenses	500	
		14 500
Establishment expenses		980
Total		72 400
per ha.		362

Example B. — *On a richer Steppe* (300 *hectares*).

1. *Distribution of surface :*

	ha.
Olives	55
Vines	3
Almonds	10
Figs	2
Prickly pear and others	8
Fallow	55
Forrage crops	55
Barley	107
Hoed crops	3
Buildings, roads, etc.	2
	300

2. *Distribution of Capital.*

	lire	lire
Price of land		30 000
Living houses		9 000
Buildings		25 000
Well		1 800
Roads		2 000
Plantations :		
Vines	1 300	
Prickly pear and others	1 600	
		2 900
20 Working animals		9 600
25 other »		6 250
Dead stock including oil extraction apparatus		16 680
Working capital :		
Food for stock	8 250	
Depreciation and repairs	1 800	
Seeds	28 000	
Labour	8 100	
General expenses	700	
		21 650
Establishment expenses		1 220
Total		126 600
per ha.		422

Lastly, estimated expenses and returns in the two above examples of mixed plantations are given in Table I :

TABLE I.

	Example *A*.						Example *B*.					
	Gross returns				Expenses	Profit	Gross returns				Expenses	Profit
	Production		Value				Production		Value			
	per ha.	total	per kg.	total			per ha.	total	per kg.	total		
	kg.	kg.	lire	lire	lire	lire	kg.	kg.	lire	lire	lire	lire
Olives, oil	6	9 720	0.80	7 760	4 400	3 360	10	14 850	0.80	11 880	6 780	5 100
Vines	3	15 000	0.10	1 500	1 000	500	6	30 000	0.10	3 000	1 700	1 300
Almonds	15	2 100	0.30	630	490	140	20	10 000	0.30	3 000	2 000	1 000
Figs	15	7 500	0.10	750	500	250	30	4 200	0.10	420	200	220
Intercalary crops	—	—	—	400	150	250	—	—	—	1 200	450	750
Barley	700	42 000	0.20	8 400	7 438	942	900	96 300	0.20	19 260	10 100	8 560
Hoed crops	—	—	—	—	—	—	—	—	—	1 500	900	600
Live stock	—	—	—	—	—	—	—	27 head	320	8 640	6 380	2 260
Total	—	—	—	19 440	13 998	5 442	—	—	—	48 900	29 110	19 790
Average per ha.	—	—	—	97.20	69.99	27.21	—	—	—	163.00	97.03	65.97

467 – **The Recent Valuation of Land other than Building Land in France.** — HITIER H. in *Bulletin de la Societé d'Encouragement pour l'industrie nationale.* Year 113, No. 2, pp. 229-241. Paris, February 1914.

According to the data collected for the new land valuation which was commenced in 1908 and is now finished, the total extent of land subject to land-tax is 125 145 373 acres.

It consist of the following groups. (Table I) :

TABLE I.

	Area, acres	Percentage of total area
Arable land	58 626 815	46.54
Forest, Alders, Osiers, etc.	24 011 371	19.06
Heaths, swamps, waste land, etc.	17 805 805	14.13
Natural meadows and pastures	17 081 429	13.56
Vineyards	3 704 283	2.94
Orchards	1 836 858	1.46
Gardens (market and flower) nurseries, etc.	980 724	0.78
Other uncultivated areas water courses, lakes, railways, etc.	1 098 088	0.87
	125 145 373	99.34
Areas under buildings	836 711	0.66
Total area	125 982 084	100

When comparing the results of this new valuation with those of the years 1851 and 1879 it appears that the arable area increased from 1851 to 1879 by about 988 400 acres, after which it decreased to such an extent that in 1908 it was 2 526 877 acres less than in 1851. On the other hand the area under meadows and pastures has increased 4 942 180 acres during the same time. The acreage of vineyards is 1 640 240 acres less than in the year 1851, whilst the private forest land has increased from 18 960 073 acres in 1851 to 20 750 066 acres in 1879 and to 21 506 549 acres in 1908.

The total capital value of all land other than building land is estimated at £2 489 619 017 and its rental value at £81 553 946. The corresponding average values per acre are £19 17*s* 10*d* and 13*s* 2*d*. Similar values in 1851, 1879 and 1908 are given in Table II :

TABLE II.

	Value of total rental	Value of total capital	Rental per acre	Value per acre
	£	£	*s* *d*	£ *s* *d*
1851	72 325 336	2 426 022 679	12 2 1/4	20 9 5 1/2
1879	104 889 004	3 631 121 087	17 0	29 7 2 3/4
1908	81 553 946	2 489 619 017	13 1 3/4	19 17 10 3/4

Both capital value and rent increased considerably from 1851 to 187 after which they sank nearly to the same level as in 1851, the value per acr being somewhat lower than in 1851 and the rental per acre a little higher.

The value of land per acre varies considerably both absolutely and re atively, according to the kind of crops carried (Table III) :

TABLE III. — *Value per acre.*

Year	Arable land						Meadow and pastures						Forest						Vineyards					
	Average rent			Average value			Average rent			Average value			Average rent			Average value			Average rent			Average value		
	s	*d*		£	*s*	*d*	£	*s*	*d*	£	*s*	*d*	*s*	*d*		£	*s*	*d*	£	*s*	*d*	£	*s*	
1851	13	6		23	14	7	1	3	5	36	3	11	6	5		10	6	0	1	2	2	33	3	
1879	18	3		35	5	0	1	11	2	47	10	2	7	5		11	19	1	2	1	9	47	12	
1908	15	9		24	0	0	1	0	10	30	2	8	5	5		9	3	10	1	4	5	32	14	

The considerable diminution in value (33 per cent.) of landed property in France since 1879 is in no wise due to a decrease of the gross return from agricultural produce but only to the reduction of net returns ; for, while the gross returns in France amounted to £706 329 120 in 1892 and rose to £848 308 608 in 1911, thus increasing in 20 years by £141 979 488, the total net returns of agriculture in France sank from £47 498 304 in 1882 to £31 718 400 in 1892 and to £30 568 808 in 1911, diminishing by £16 929 696 during the last 30 years. The change has been caused by increased financial burthens laid upon agriculture together with constantly increasing expenses.

Though the average value of land has diminished so considerably for the whole of France, it has neverthe less continuously increased in some parts of the country. In this respect the contrast is most striking between the east and west of France. While in Brittany the average rent per acre has risen from 9*s* 4*d* in 1851 to 15*s* 9*d* in 1879 and 16*s* 4*d* in 1911, in the eastern departements Meuse, Meurthe-et-Moselle, Marne, Haute Marne and Haute Laône it rose from 10*s* 3*d* in 1851 to 13*s* 6*d* in 1879 and then fell again to 9*s* 4*d* in 1908. The difference is explained, according to the writer, by the fact that in the west, in Brittany, agriculture has made great progress owing to the still abundant agricultural labour, to the recently improved means of communication, to the use of artificials on poor heath lands and so forth while in the east the lack of labour is always more keenly felt and the returns from the vineyards, one of the chief sourses of revenue, are constantly diminishing. In Brittany 226 978 agricultural labourers are available for 6 733 389 acres, (3.24 per 100 acres), while in the east there are only 66 84 for 7 708 543 acres (or 0.81 per 100 acres).

468 – **Cost of Production, Marketing and Exporting Wheat in Canada.** — *Synopsis of the Report of the Saskatchewan Royal Commission on Grain Markets*, pp. 1-3. Regina, Saskatchewan, January 1914.

In their report into the ways and means for bettering the position of Saskatchewan grain on the European markets, the Saskatchewan Royal Commission on Grain Markets gives the costs of production, marketing and exporting wheat as follows:

The average cost of producing wheat amounts to 55 cents per bushel on the farm, and 62 cents when placed on a car at a country point.

Data is presented to show that the cost of production has increased 12.15 per cent. since 1909, while the price of wheat paid to the farmer has constantly diminished. The prices are as follows:

1909	81 1/8	cents per bushel
1910	76 1/8	» »
1911	74 1/8	» »
1912	69	» »
1913	66 1/8	» »

The total cost of marketing the wheat for export has increased since 1909 as is shown by the following figures which refer to 1000 bushels of wheat from the shipping point to the European port:

	1909	1913
	$	$
1) For receiving, weighing, elevating, cleaning, spouting, insuring against fire, storing and loading into car.	17.50	17.50
2) Railway carriage:		
a) to Winnepeg, on average	120.00	12.000
b) from a lake port to Montreal	42.50	42.50
3) For sampling and inspecting at Winnipeg, for cargo inspection and weighing out at Fort William	1.60	1.60
4) For selling wheat on Winnipeg grain Exchange	10.00	10.00
5) For the exporter, say.	10.00	5.00
6) To the terminal elevator owner, for receiving, elevating etc.	7.50	7.50
7) Interest and exchange on money supplied by bank	14.40	16.40
8) Lake Steamship Co. for carriage	10.00	20.00
9) To Transfer Elevator Co. for elevation from vessel to cars and transfer to ocean vessel	11.50	11.50
10) To Ocean Steamship Co., freight	40.00	75.00
11) Marine Insurance	9.60	9.60
12) Sundry charges	10.00	10.00
	$ 304.60	$ 346.60

469 – **The Cost of Raising a Dairy Cow.** — BENNET, C. M. and COOPER, M. O. in *Bulletin of the U. S. Department of Agriculture*, No. 49, pp. 1-23. Washington, January 14, 1914.

The writers availed themselves of carefully kept accounts of a farm in Wisconsin covering a period of five years, in order to determine the cost of

raising a heifer from the time of its birth to the dropping of its first calf and entry into the dairy herd.

The heifers kept on this farm are Jerseys. During the five years (1907-1912) over which the calculations extend 73 heifers were raised. September 1st was taken as the beginning of the year, for by that time the greater number of the cows in the farm had calved. When calculating the cost during individual months, in order to avoid any error caused by the addition of a new calf or the withdrawal of another from a group, the average number of head in the various groups is calculated on the basis of the feed days.

The cost of production is illustrated by complete records of one group of calves from birth in September 1909, up to the time they entered the herd in September 1911. The quantity and cost of the food consumed, and the amount and cost of manual and horse labour are given in Table I.

TABLE I.

Item of cost	1st year		2nd year		3rd year	
	Actual cost	Per cent.	Actual cost	Per cent.	Actual cost	Per cent.
Food	$ 24.58	68.4	$ 16.11	62.8	$ 40.69	65.6
Labour	5.14	14.3	2.86	11.0	8.00	12.9
Interest	1.12	3.1	2.53	9.9	3.65	5.9
Buildings	1.57	4.4	0.81	3.1	2.38	3.8
Equipment	0.55	1.5	—	—	0.55	0.9
Bedding	1.00	2.8	2.00	7.8	3.00	4.8
Miscellaneous expenses	0.28	0.8	0.16	0.6	0.44	0.7
General expenses	1.71	4.7	1.22	4.8	2.93	4.7
Losses by death and discarding	—	—	—	—	0.42	0.7
Total	35.95	100	25.69	100	62.06	100
Credit, manure	3.00	—	5.00	—	8.00	—
Total cost of raising	32.95	—	20.69	—	54.06	—
Initial value of calf	7.00	—	—	—	7.00	—
Total net cost	39.95	—	20.69	—	61.06	—

After some explanations as to the way the various items of the above table have been calculated the writers compare (in Table II) the cost of raising heifers belonging to different groups (1908, 1909 and 1910) for two years.

The average net cost of a dairy heifer two years old is $ 61.41, which consists of its initial value $ 7.04, food $ 40.83, labour $ 7.81 and other costs as per table I $ 13.73 making a total of $ 69.41 minus $ 8 for manure. The most important item of cost is the food, which amounts to 65.5 per cent.

TABLE II.

Item	1908 group		1909 group		1910 group	
	Actual cost	Per cent.	Actual cost	Per cent.	Actual cost	Per cent.
Whole milk	$ 4.74	12.1	$ 5.28	12.8	$ 7.36	17.4
Skim milk	7.89	20.0	6.33	15.6	6.91	16.3
Roughage	16.60	42.1	16.81	41.3	18.40	43.6
Grain	6.44	16.3	6.94	17.0	4.45	10.5
Pasture	3.73	9.5	5.33	13.3	5.19	12.2
Total cost of food	39.49	100.0	40.69	100.0	42.40	100.0
Food	39.40	65.5	40.69	65.5	42.40	65.4
Labour	7.86	13.0	8.00	12.9	7.56	11.6
Other costs	12.91	21.5	13.37	21.6	14.91	23.0
All costs	60.17	100.0	62.06	100.0	64.87	100.0
Credit, manure	8.00	—	8.00	—	8.00	—
Cost of raising heifer	52.17	—	54.06	—	56.87	—
Initial value	6.30	—	7.00	—	7.83	—
Total net cost of production	58.47	—	61.06	—	64.70	—

The manure practically offsets the cost of labour, and may therefore be omitted in the calculations ; this is all the more worthy of note inasmuch as the accurate calculation of the cost of labour is the most difficult part of the whole work.

AGRICULTURAL INDUSTRIES.

470 – **On the Schardinger and Other Reactions of the Ferments of Goats' Milk.** — WEDEMANN W. in *Biochemische Zeitschrift*, Vol. 60, No. 4, pp. 330-343. Berlin March 13, 1914. DAIRYING.

The following results have been obtained from a biological study of the milk of 16 goats of different origin and in different stages of lactation :

1) A solution of methylene blue in formaldehyde (Schardinger) is not discoloured by either fresh or stale milk or by cream. This is in accordance with results obtained by other investigators.

2) A solution of hydrogen peroxide (1 per cent.) is only slightly decomposed by fresh milk, showing that it only contains a very small amount of catalase.

3) Rothenfusser's and Storch's reagents and benzidin (di-amino benzol) are decomposed by fresh goat's milk as well as by cow's milk.

4) The quantity of Schardinger's enzyme is constant throughout the lactation period whether the goats are rearing their young or otherwise. Infection with contagious abortion does not affect the milk in this respect.

471 – **Caseinogen and Casein** (1), — GEAKE, A. (University of Bristol) in *The Biochemical Journal*, Vol. VII, No. 1, pp. 30-37. Cambridge, February 1914.

With the idea of establishing the chemical identity or dissimilarity of casein and caseinogen, the writer carried out a series of experiments to determine the composition of the two compounds. The carbon, hydrogen, nitrogen, sulphur, and phosphorus content was estimated, and the Hausmann numbers (*i. e.* proportion of the total nitrogen present as ammoniacal nitrogen, melanin nitrogen, diamino nitrogen, monamino nitrogen) were determined for both casein and caseinogen with the result that no appreciable differences could be detected between the two compounds.

472 – **The Biological Examination of Houey.** — THÖNI, J. in *Schweizerische Bienen-Zeitung*, Year 37, No. 1, pp. 23-31. Aarau, January 1914.

The progress achieved in the manufacture of artificial honey, which is now very similar to real honey in its physical and chemical properties, has led to the adoption of new methods of examining honey based on biological instead of chemical and physical characters. At present two such methods are in use by means of which any adulteration is immediately detected. They are the diastase reaction and the quantitative precipitin reaction.

The diastase reaction is based on the fact that honey contains a diastatic ferment secreted by the bee which, in contact with soluble starch, is capable of transforming the latter into sugar. The precipitin reaction is based upon the fact that honey contains a special protein secreted by the bee which when inoculated into rabbits, causes the formation of antibodies in the blood sernm; these antibodies when mixed with the honey under examination yield a precipitate. The quantity of this precipitate indicates the kind and amount of the adulteration. Instead of using honey for inoculating the rabbits, extracts from the bodies of bees can be used or bees bread from queen cells and other cells. The two latter are especially suitable on account of their high content of bee protein, and produce a serum with a high content of antibodies. As the amount of precipitate may vary considerably for the same solution of honey according to the bee protein used, tests should always include a control which consists of some absolutely genuine bee honey as similar as possible to the honey under examination in appearance and in consistency.

The details of both methods of analysis are the following:

Diastase reaction. — 10 cc. of the honey to be examined (concentration of the solution, 1: 2) are mixed in a test tube with 1 cc. of a 1 per cent.

(1) The writer refers to the work of VAN SLYKE and BOSWORTH (see No. 283, *B.* March, 1914) but his nomenclature differs from theirs:

"Caseinogen" in the present paper being equivalent to "casein" in the former paper and "casein" in the present paper being equivalent to "paracasein" in the former paper.

olution of soluble starch and kept for an hour in a water bath at 45° C. 13° F.). If diastase is present in the solution of honey, the starch during is time will be converted into sugar. This is ascertained by removing ie test bube from the water bath, adding to its contents 1 cc. of solution potassium iodide, shaking it and examining the intensity of colour. If l the starch is transformed into sugar, the colour of the mixture is only ery slightly darker than that of the original solution of honey. If no arch has been transformed the colour of the solution is deep black blue. xamined by this method most genuine centrifugated honey gives a light ive green to a light brown colour. Boiled solutions of honey assume a eep blue to black blue colour because they do not contain any more active iastase. Honey that has been heated shows, according to the degree and uration of the heating, colours varying from red brown, brownish, olive, ght bluish green and blue green to deep blue. Artificial honeys show lways deep black blue, because they naturally do not contain any dias- se. Heat appears to exert an action on the result of the diastaze reac- on only above 90° C.

Quantitative precipitin reaction. — Three solutions of each kind of oney to be examined are prepared containing 10 per cent., 2 per cent. id 1 per cent. respectively, and 1 cc. of each is used. The bee protein rum is added in definite proportions (0.5 cc. of serum to the 10 per nt. solution, 0.3 cc. to the 2 per cent. solution and 0.2 cc. to the per cent. solution) with one drop of toluol in order to suppress any evelopment of bacteria. The whole is them left for 5 hours at 35° C. 5° F.) Special glass tubes (mellimeters) are used for the reception of the ove mixtures, the lower part of which are narrowed and graduated so as allow of an accurate determination of the amount of the precipitate. fter standing 5 hours at 35° C., by which time the formation of the precipi- te may be regarded as complete, the test tubes are centrifugated for 5 inutes, thus forcing the precipitate into the narrowed portion of the tube here it can be read off. In general there is no difficulty in judging the sults of the examination according to this method. If the amount precipitate obtained is equal or larger than that obtained from the stan- rd or control, then the sample may be considered genuine, while if the iantity of precipitate is considerably less than that of the control then the mple, is a mixture of genuine and artificial honey or consists of partially de- tured honey. It is not possible however to know whether the sample s been mixed or denatured. The total absence of precipitate or the esence a very small quantity only in the 10 per cent. solution indicates e presence of artificial honey or of honeys the proteins of which have been stroyed. Wild honeys in general give smaller precipitates than flower neys. while in the case of honeys produced by pure sugar feeding, the antity of precipitate is about one half of that of genuine bee honey. eating honey for one hour at the temperature of boiling water causes the ecipitate to fail completely.

MILLING INDUSTRY.

473 – **Preliminary Investigation into the Variation in the Physical Composition of Wheat Milling Offals.** — CRANFIELD, H. T. in the *Journal of Agricultural Science.* Vol. VI, Part I, pp. 102-110. Cambridge, January 1914.

This investigation was carried out in the hope of devising a simple method of classifying the different grades of wheat offal that would form a suitable basis for market standardisation. Some 100 samples were collected from various parts of the country and arranged into ten groups according to their physical appearance. Determinations of the percentage of moisture, density and proportion of flour were made so as to obtain some idea of the value of classifying according to external appearance.

It was found that the percentage of moisture varied from 11.37 to 16.21. Samples containing more than 15 per cent. are liable to turn mouldy very quickly. The most important constituents are the husk and flour and these differ widely in their densities, so that the density of a sample is an indication of the proportions of these two constituents.

Density determination were made as follows: about 20 gm. of the offal were dried at 100° C. for 5 hours and cooled in a desiccator. Fifteen grams were weighed and placed in a 100 cc. graduated cylinder; the settling was effected by jolting to constant volume before and after weighting with a 100 gm. lead weight made to fit the cylinder exactly and having a stout rubber washer glued to the bottom. Abnormal results were obtained with samples containing a large quantity of semolina and samples of small bran rolled to give the appearance of broad bran.

The proportion of flour was estimated in terms of the percentage starch present which was determined as follows: 5 gm. of the offal were placed in a bag of fine silk gauze and kneaded in successive quantities of hard tap water until the final liquid gave no reaction with iodine. The washings were made up to 500 cc., and 50 cc. of the well shaken milky liquid were pipetted into a Gerber test tube and centrifuged by hand for 5 minutes. The clear supernatant liquid free from starch was decanted off and more water added, the starch deposit stirred up and the tube again centrifuged. This process was repeated with ordinary alcohol and finally with absolute alcohol. The deposit of starch was then dried at 100° C. and weighed. With fine offals the crude starch obtained in this way contained a small and fairly constant percentage of protein matter (about 3 per cent.), but with bran and coarse offal the percentage of protein averaged 13.5 per cent.

The chief impurities in wheat offals are weed seeds and oat husks. More rarely are found barley husk, rice husk, coffee bean husk and tapioca.

The writer suggests that the following determinations should be made in grading milling offals: percentage of moisture, apparent density, percentage of starch (or flour), purity; and that a series of grades should be arranged in cooperation with the millers, with stated limits for these determinations.

474 — **A New Process of Preparing Potatoes for Acid Ensilage with Pure Cultures of Lactic Bacteria.** — FOTH, G. in *Zeitschrift für Spiritusindustrie*, Year XXXVII, No. 8, p. 103. Berlin, Febraury 1914.

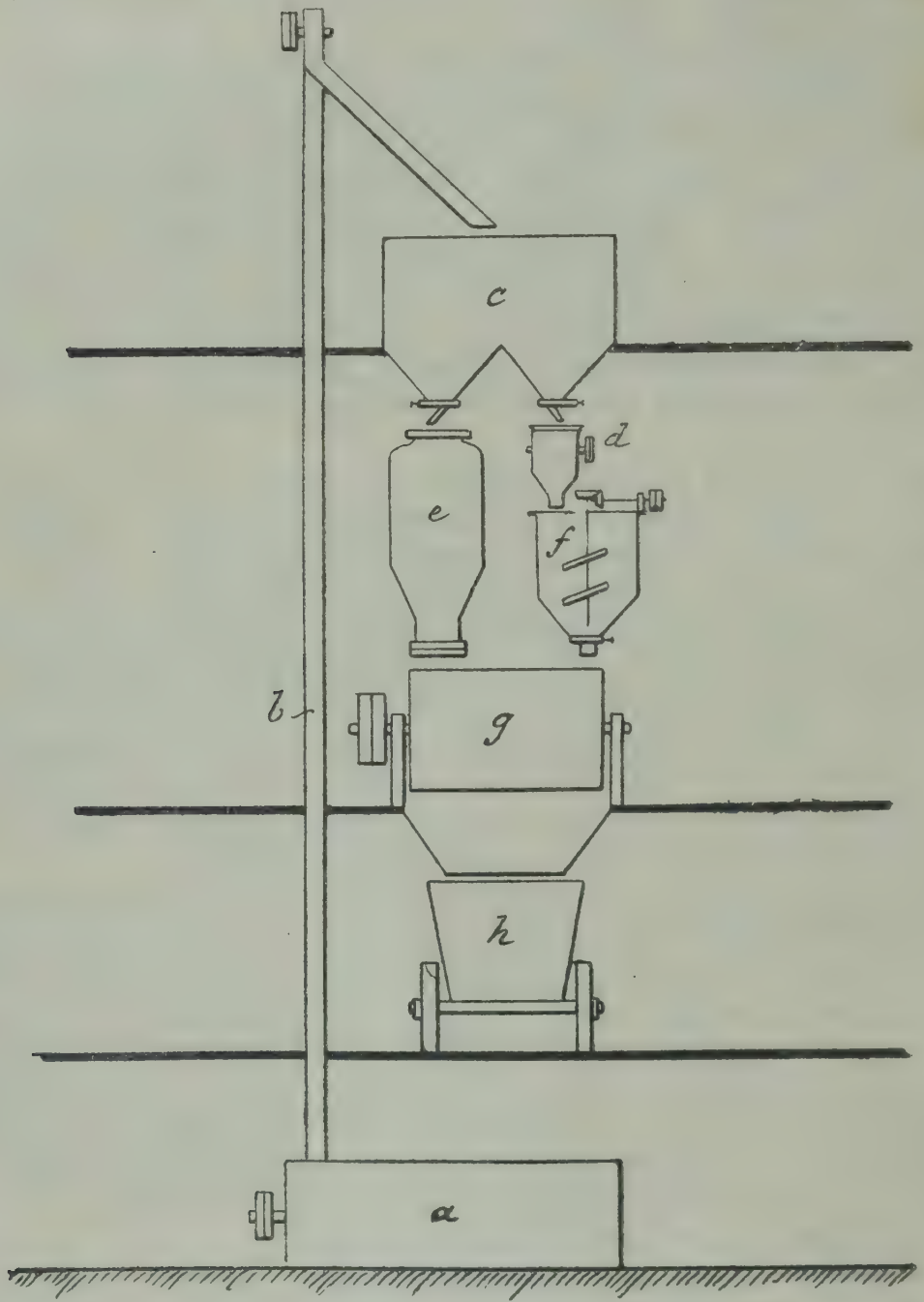
Numerous experiments have shown that, in the preparation of acid silage, considerable losses of nutritive matter can be avoided by the use of pure cultures of lactic ferments, a more conservable and hygienic product being obtained. Attempts have also been made to apply this principle to practical agriculture. In doing so, two conditions must be fulfilled, *viz* : *a*) the lactic ferment must be uniformly distributed throughout the mass ; and *b*) a suitable temperature must be maintained. These conditions may be fulfilled by grating the potatoes in two separate lots one of which is steamed. The writer describes the process of obtaining a uniform mass consisting of cold grated potatoes and steamed potato paste in a special apparatus.

The general plan of this apparatus is shown in the accompanying diagram : the washed potatoes are transferred from the washing trough (*a*) to the distributor (*c*) by means of an elevator. One lot are then fed to the steam heater (*e*) and from this to the pulper (*g*) by means of an Archimedes' screw; or through several small heaters which are charged alternately and discharged into the pulper (*g*). The second lot of potatoes are passed through the grater (*d*) into the vat (*f*) fitted with a rapid stirrer from which they pass into the mixer (*g*), which is similar to those used for mixing manures or for kneading the dough in bread making. This mixer is placed at height of about 8 feet from the ground so that a waggon may be conveniently placed below to receive the fermented ensilage.

The apparatus works as follows : to produce 30 cwts of ensilage by the warm fermentation method, 15 cwts of potatoes are heated by steam and 15 cwts are grated in the cold. Both lots are passed into the mixer and the temperature of the mixture becomes equal to the average of the temperatures of the pulp before mixing, *i. e.* about 55° C. The lactic ferment is added and thoroughly mixed with the pulp. Cold fermentations are obtained by increasing the quantity of raw grated potatoes and decreasing the quantity of hot potato mash. When the kneading is complete and the ferment evenly distributed, the mass is discharded into the waggon placed below. From four to five kneadings can be carried out in one hour.

Other hashed forage such as mangel leaves and potato haulm may be added to acidify the steamed potatoes. Where available, brewer's grains may also be substituted for the grated potatoes.

The writer believes that the use of this plant is not only technically possible but also economically sound, since the steam required for the washing, elevating and mixing machines can be used for heating the potato pulp.



a) washing trough.
b) elevator.
c) distributor.
d) grater.
e) steam heater
f) vat with stirrer.
g) pulper.
h) waggou.

475 – **The Utilisation of the Proteins of Cotton Seed by Man.** — RATHER, J. B. (Texas Experiment Station) in *The Journal of the American Chemical Society*, Vol. XXXVI, No. 3, pp. 584-586. Washington, D. C., March 1914.

Experiments on the digestibility of cotton seed meal and cotton seed flour by man have been carried out in two trials. Three men were used in one trial and two in the other. The cotton seed was fed in a simple diet of milk, butter and bread made of corn meal and of the cotton seed meal or flour to be tested, and it was compared with a canned chicken product. The trials lasted two days each, charcoal being used as indicator in the faeces.

The sifted cotton seed meal contained 46.33 per cent. protein and the flour contained 50.16 per cent. protein, and it was mixed in the bread to the extent of 26 per cent. The utilisation value of the milk in the diet was assumed to be 97 per cent. and that of the cornmeal 85 per cent.

The utilisation value of the cotton seed protein in the meal averaged 77.6 per cent. and in the flour 79.5 per cent. The value of the meat proteins was 96.6 per cent. Thus, taking 78.6 per cent. as the average digestibility value of cotton seed protein, it is equal to that of legumes (78 per cent.), nine tenths that of cereals (85 per cent.) and eight tenths that of meat.

476 – **Mechanical Treatment of Oil Palm Fruits.** — KEMMER, W. in *Verhandlungen der Oelrohstoff-Kommission des Kolonial Wirtschaftlichen Komites*, No. 1, pp. 17-22. Berlin, November 3, 1913.

The fruits of the oil palm are borne in large clusters at the crown resembling huge strawberries, which weigh sometimes as much as 110 lbs. each. The individual fruits are about the size and shape of a pigeon's egg, and they consist of an outer oily pulp and of a hard nut enclosing an oily kernel.

These clusters are knocked down by the natives and kept in the shade until the fruits fall out of their own accord ; they are then heated in shallow pans for several hours over a fire, after which they are thrown into an old canoe or any suitable trough and stamped under foot or beaten with clubs until the pulp is separated from the nut. The addition of water hastens the process. The pulp and the oil, already floating on the surface, are collected, and the oil still remaining in the pulp is squeezed out by hand. The oil after being boiled and clarified is ready for sale. The nuts are spread out in the sun to dry, then cracked with a stone, the kernels picked out and packed for sale. It has been calculated that with this system it takes 10 strong negroes 26 days to produce 880 lbs. of oil.

Until lately all the palm oil and kernels exported from the West coast of Africa were prepared by these primitive processes, which extracted only about 7 per cent. of oil from the fruit. After several years of experiments the firm Haake, with the support of the Colonial Economic Committee, succeeded in building in 1907 a machine which was the first step towards the mechanical production of palm oil and kernels. The North West Kamerun Co. was the first to prepare palm oil on Haake's system. Two years later the West African Plantation Co., under the writer's management, adopted the same system, which meanwhile had been improved, and so did a French Company of the Ivory Coast and the Agu Plantation in Togo.

Haake's system is based on the so-called "wet process" as follows: the fruit is cooked in large pans and then freed from the pulp in special machines; the latter is then allowed to stand to drain, after which it is again heated and put under the presses. The palm nuts are cracked in a large centrifugal machine and the kernels separated from the shells by a drum shaped sieve or by brine. With this process 100 lbs of palm fruits yield 15 lbs of oil and 14 lbs of kernels; 4 or 5 tons of fruit can be treated daily by 15 to 20 men.

The quality of the oil is very much the same as that produced by the native process. It contains a high percentage of fatty acids, often above 30 per cent., and can therefore only be used for the manufacture of soap or candles. Some sorts of oils prepared by the natives however, such as the best Lagos oils, were superior to the most carefully made mechanical oils. Of late years palm oil has also been in demand for human food. For this purpose however it must not contain more than 12 per cent. of fatty acids at a maximum. Consequently the firms which have recently taken up the mechanical preparation of palm oil attached great importance to the production of an oil containing a low proportion of fatty acids, and as the intimate mixture of water with the oil during the process of manufacture favours the production of these acids, a new process, the "dry process", was developed. The fruits were pressed without previously mixing them with water. They required repeated pressing in order to extract all the oil. Several firms adopted this system which gives a higher yield of oil and an oil with a lower fatty acid content than the "wet process" though not yet up to the requirements of the edible oil industry.

The various palm oil factories continued to devote their attention to the problem of improving both yield and quality of the oil, and at a conference of German palm oil producers, summoned by the writer in September 1913, it appeared that several firms, amongst which was the Agu Plantation in Togo, had succeeded in producing a palm oil which did not contain more than 8 per cent. of fatty acids.

The Agu process is based upon the native processes which yielded the best oils, and consists essentially of the following operations:

The fruit are no longer separated from each other, thus saving much labour, only the core is cut out. As soon as possible, *i. e.* within 2 hours from being gathered, they are heated up to 100° C. (212° F.) and maintained at this temperature to prevent the formation of fatty acids. They are then thoroughly crushed in a machine so as to break up the cells and render the pressing easier. One pressing only is required, and this is another advantage over the other systems. On the Agu Plantation, 16 and even 17 per cent. of oil have been obtained, and from 10 to 11 per cent. of kernels.

477 - **The Respiration of Fruits and Growing Plant Tissues in Certain Gases, with Reference to Ventilation and Fruit Storage.** — HILL, G. R. in the *Cornell University Aricultural Experiment Station, Bulletin* No. 330, pp. 377-407. Ithaca, N. Y., April 1913. — 2. BOODLE L. A. in the *Bulletin of Miscellaneous Information, Royal Botanic Gardens, Kew*, No. I. pp. 11-16. London, February 1914.

1. — The softening of peaches due to the rapid hydrolysis of the pectose in the cell walls and the phenomenon of " ice-scald ", or the decay of the tissues beneath the skin of the fruit on storage, suggested experiments to determine the factors influencing the metabolic processes occurring in fruits. The existing literature shows that many katabolic processes due to enzymes occur in plant tissues and that carbon dioxide is produced in the absence of oxygen. Protein decomposition also takes place and alcohol, lactic acid and glycerine, etc., are produced by the action of zymase on suitable carbohydrates.

The first of these experiments deals with the effect of nitrogen and hydrogen on the rate of evolution of carbon dioxide by ripe cherries, blackberries, green peaches, ripe grapes, and germinating wheat. The fruits are placed in respiratory bottles of 250 cc. capacity. The gases were passed through the bottles, dried by means of calcium chloride, and the carbon dioxide collected in potash bulbs. The temperature was controlled to within 0.5° C. by means of an electric thermostat.

The results obtained with the various fruits are as follows :

Ripe cherries. — Respiration in air at 30° C. increased after 60 hours, probably owing to increased production of enzymes. In nitrogen and hydrogen there was a slight decrease in respiration after 36 hours.

Green peaches. — In air there was a steady decline in the production of carbon dioxide during the first 60 hours, after which it remained almost constant. The production of CO_2 was less in both nitrogen and hydrogen and the constant rate was reached earlier (about 40 hours).

Ripe grapes. — Respiration was equally rapid in air, nitrogen and hydrogen, and equal to about half the rate of that of ripe cherries under similar conditions.

Germinating wheat at 25° C. — The respiration of seeds sterilised in formalin was greater than that of seeds sterilised in alcohol. It was much slower in hydrogen and nitrogen than in air.

These results show that in tissues containing actively growing protoplasm, the absence of oxygen results in a marked decrease in the respiratory rate. On the other hand the activity of mature tissue such as the pulp of ripe fruits is unaffected by the absence of oxygen. The rate of anaerobic metabolism in ripe cherries is much greater than that of grapes and green peaches, and since cherries spoil more quickly, there would appear to be a connection between the rate of spoiling of fruit and the rate of respiration.

Experiments were then carried out to test the keeping qualities of fruits in closed jars containing nitrogen, hydrogen, carbon dioxide and air.

Sterilised glass jars of 4 litres capacity were used and small bottles of sulphuric acid and potash were placed in the jars to prevent the accumul-

ation of moisture and carbon dioxide. The apples were sterilised by dipping in 95 per cent. alcohol and rinsing in sterile water. No attempt was made to sterilise the peaches. The jars were sealed except those containing air which were plugged with cotton stoppers, and kept in the laboratory at a temperature between 21° to 23° C. The results were as follows :

Apples. — Of the apples stored in air 2 were almost completely destroyed by brown rot, but the remaining 5 were in good condition and much less sour than at the beginning of the experiment. The apples stored in nitrogen and hydrogen entirely lost their red colour and looked as if they had been half baked in a slow oven. The skin showed small blisters and the flesh was light brown at the surface and white inside, rapidly darkening on exposure to air. The natural flavour was almost entirely gone. Attempts to obtain cultures of organisms from the brown flesh were unsuccessful showing that these effects were the result of anaerobic metabolism of the fruits.

Peaches. — Hard market-ripe peaches were used, 10 being placed in each jar. At the end of seven days, only 3 peaches were free from rot in the jar containing air. These three peaches were in good condition, of a beautiful cream colour, soft, juicy and of excellent flavour. Those stored in nitrogen, hydrogen and carbon dioxide were unchanged in appearance but had acquired a bad flavour and darkened rapidly on exposure. At the end of four weeks, those in nitrogen and hydrogen were mostly brown and soft and had entirely lost their aroma and flavour. Some of them had hard green spots with a decidedly bad flavour. The peaches in carbon dioxide were mostly green and as hard as when placed in the jar four weeks earlier, but they had a bitter nauseating flavour similar to that of the hard green spots of the fruits in nitrogen. When exposed to air they turned brown very rapidly but did not markedly soften.

Further experiments were carried out to determine the effect of the degree of ripeness on the rate of softening of peaches. Fruits were selected at three stages, *viz*. very ripe, market ripe and hard green. They were allowed to remain in the gases for two weeks. The peaches in air retained their qualities and ripened well, but the very ripe fruits and some of the others were attacked by brown rot after a few days. The ripe fruits developed a bad flavour in all three gases, darkened noticeably and had the appearance of peaches that had been badly injured in shipment in refrigerator cars. The hard green fruits remained hard in all of the oxygen-free gases.

The foregoing results show the importance of thorough ventilation of stored fruits. It would appear that ice "scald" of peaches is due to the accumulation of carbon dioxide within the wrappings of the fruits. The question of a suitable wrappers for fruits is therefore worthy of investigation from the stand point of ventilation. The softening of peaches can be prevented by inert gases, but there yet remains to be found a method which does not influence the flavour of the fruits.

2. — The writer commenting on the above results points out that the amount of carbon dioxide produced per hour by 100 gm. of ripe grapes at 30° C. was 5.2 mgm. or 2.9 cc., so that at this rate the grapes would

give off a volume of carbonic acid equal to their own bulk in about 32.6 hours, and ripe cherries would produce this amount in 11.8 hours. Active respiration is accompanied by evolution of heat which accelerates the rate of respiration. Thus, if aeration is insufficient, local heating occurs at " compound interest ", and the refrigerating apparatus is unable to cope with the increasing temperature. The following results of an experiment are given by way of illustration.

An insulated storage room of 6000 cubic feet capacity was fitted with a refrigerating machine capable of reducing its temperature to 27° F. (or -3° C.). Six tons of vegetables in boxes were placed in this room in order to store them at 35° F. (2° C.). The initial temperature was 59° F. (15° C.) and after 10 hours' working the machine was not able to reduce it below 50° F. (10° C.). The refrigerator was stopped and in 12 hours the temperature had risen to 59° F. and in 15 hours more it reached 66° F. (19° C.). The outside temperature during this time varied between 45° and 52° F. (7° and 11° C.).

The successful cold storage of fruits and vegetables therefore involves a suitable system of spacing out and packing in order to insure efficient aeration and consequent retarding of the rate of respiration. This may so increase the cost of running expenses as to make the process commercially impossible.

478 – **The Successful Storage of Californian Table Grapes.** — STUBENRAUCH, A. V. and MANN, C. W. in the *Bulletin of the U. S. Department of Agriculture, Contributions from the Bureau of Plant Industry*, No. 35, pp. 1-31. Washington, D. C., December 13, 1913.

Experiments have been conducted by the Bureau of Plant Industry during 7 years, on the methods of packing and storing Californian grapes with a view to extending the area of distribution and reaching new markets. Various grades of granulated cork and sawdust were tested with several varieties of grapes.

It was found that coarse, kilndried redwood sawdust gave as good results as the granulated cork used by Spanish packers. The redwood should be absolutely pure as the slightest admixture of pine, cedar or spruce is liable to taint the flavour of the grapes. It should be carefully dried either in kilns or in the sun and fanned to remove the finer particles which are troublesome when the fruit is unpacked. Only varieties with open bunches should be packed in this material so as to facilitate the removal of the sawdust on unpacking.

A drum barrel made of thin veneered cotton-wood, lined with heavy strawboard with a net capacity of 27 lbs has been found a most suitable container. The fruit should be cooled overnight before packing as the drums cool very slowly during refrigeration. On reaching their destination the drums should be placed in cold storage at a temperature of 32° F.

Since this system of handling grapes is an expensive one it will only prove profitable for the best grades of fruit which can be marketed at comparatively high prices, and which are unadapted to shipment in crates without a filler.

PLANT DISEASES.

GENERAL INFORMATION.

LEGISLATIVE AND ADMINISTRATIVE MEASURES

479 – **Legislative Measures Concerning Plant Diseases, in Egypt.** — *The Agricultural Journal of Egypt*, Vol. III, Part. I, pp. 42-46. Cairo, 1913.

The principal legislative measures dealing with agriculture in Egypt are summarised and translated into French in the above article. Those relating to plant diseases are as follows:

A. Two Khedival decrees relating to the destruction of locusts, dated June 16, 1891, and April 26, 1904 respectively.

B. 1) The law No. 13, of April 17, 1905 indicating destructive measures to be taken against *Prodenia litura* (cotton worm).

2) The law No. 9, of April 17, 1910 modifying the preceding by granting compensation for additional labour in the collection and destruction of cotton leaves containing the eggs of the insect.

3) The law No. 3, of April 7, 1910 compelling notification of the appearance of *Prodenia*.

4) The law No. 14, of August 30, 1906 extending the measures of the preceding law to all insects and pests which attack the cotton and reduce the yield.

5) Law No. 13, of June 8, 1912 modifying art. 3. of law No. 13, 1905 and charging the owners of land infected by *Prodenia* with the travelling expenses of labourers sent by the administrative authority; also modifying the penalties inflicted on contraveners by art. 6 of the same law (No. 13, 1905), and by art. 1 of the law No. 3, 1906.

6) The law No. 6, of April 9, 1913, containing the measures for the prevention of the propagation of *Prodenia* by means of the cultivation of « bersim » or Alexandrian clover.

C. The law No. 19, of June 30, 1912 determining the measures for the destruction of *Earias insulana* (« cotton pod worm »).

D. The law No. 5 of 11 March 1913 for the protection of plants against the diseases of other countries (1).

E. 1) The law No. 9 of May 15, 1912 for the protection of birds useful to agriculture, appended to which is a list of birds.

2) The ministerial decree No. 46, S. A. of December 3, 1912 including in the above law (No. 9, 1912) the golden oriole (*Oriolus oriolus*).

(1) See also No. 751, *B*. June 1913.

DISEASES NOT DUE TO PARASITES AND OF UNKNOWN ORIGIN.

480 – **On the Pathological Significance of Endocellular Threads in the Tissues of the Vine** (1). — PETRI L. in *Rendiconti delle sedute della Reale Accademia dei Lincei, Classe di Scienze fisiche, matematiche e naturali, Series* V, Vol. XXIII, 1st Series, Part 3, pp. 154-161, + 1 Fig. Rome, 1914.

The writer confirms his theory that the presence of particular endocellular threads in the tissues of the vine indicates a pathological condition connected with the effects of low temperatures on the plant.

BACTERIAL AND FUNGOID DISEASES.

481 – **Some Japanese Fungi.** — ITO SEIYA in *The Botanical Magazine*, Vol. XXVII, No. 323, pp. 217-223. Tokyo, 1913. FUNGI.

In 1910, T. MIYAKE recorded a serious fungus disease on the leaves of sugar cane, which has since been found in almost all districts. It has been attributed to a new species of *Sclerospora*, *Scl. Sacchari* T. Miyake (1911). The conidia germinate directly like those of *Peronospora*, producing a hyphal tube. Considering the differences in the process of germination, the writer proposes to divide the genus *Sclerospora* into two sub-groups: *Eusclerospora* (with conidia germinating by zoospores) and *Peronosclerospora* (conidia producing hyphae directly). Recently (1913) G. S. KULKARNI has found a new variety of *Sch. graminicola* on the leaves of *Andropogon Sorghum* in India. In this case also the conidia produce hyphae, so that *Scl. graminicola* var. *Andropogonis-Sorghi* constitutes a second member of the sub-genus *Peronosclerospora*. Comparative researches and cultivation experiments are necessary to determine if this fungus is identical with *Scl. Sacchari*.

In 1907, H. and P. SYDOW and E. J. BUTLER described under the name of *Ustilago Rottboelliae* Syd. and Butl., a smut disease found by Butler on *Rottboellia compressa* L. at Pusa. In 1913 I. MIYAKE described a fungus *U. Rottboellia* n. sp. collected by him in China (Tichang, Hupei) in September 1908. No *Ustilago* has yet been recorded on *Rottboellia* in Japan. The writer found the fungus in the province of Echigo in the summer of 1910 and has also examined a specimen collected in the same province by K. YOSHINO in August 1900.

From the descriptions of SYDOW, BUTLER and MIYAKE, the fungi found in India, China and Japan appear to belong to the same species.

(1) See No. 289, *B.* March, 1914. (*Ed.*).

The writer's observations agree in the principle points with those of the preceding observers and the species should be named *U. Rottboelliae* Syd. and Butl.

In 1901 P. HENNINGS described a new species, *Aecidium Epimedii* Henn. and Shir. collected by M. SHIRAI as a parasite on the leaves of *Epimedium macranthum* Morr. and Decne., in the province of Izu. The teleutospore form has not yet been recorded, but in July 1905 the writer observed them for the first time, occuring in a leaf spot resembling the aecidial stage. Later he found them in various parts of the province and has observed the two forms, teleutospore and aecidium, on the same leaf. The writer, therefore, provisionally describes these forms as *Puccinia Epimedii* (Henn. and Shir). Miyake and Ito and consider them as forming a new species.

Under the name of *Gymnosporangium japonicum*, P. SYDOW described, in 1899, a fungus found by M. SHIRAI at Tokio (Komaba) on the stems of *Juniperus chinensis* L. In 1900, SHIRAI observed as a result of cultural experiments, a similarity between *Roestelia koreaensis* P. Henn (= *Tremella koreaensi* Arth.) on the leaves of *Pyrus sinensis* Lindl. and *Gymnosporangium japonicum*, in that the spores of *Gymnosporangium* not only appeared on the trunk and branches of *J. chinensis* (as in the original diagnosis of SIDOW) but also on the leaves. K. MIYABE and G. YAMADA also hold the view that the forms of *Gymnosporangium* on the bark and leaves of *J. chinensis* cannot be considered as belonging to the same species.

In order to decide this question the writer repeated infection experiments in May 1913 with spores from diseased stems of *Juniperus* (bark type of *Gymnosporangium*) and from the leaves of *Pyrus sinensis*, *P. malus* L., *Amelanchier asiatica* C. Koch and *Pourthiaea villosa* Decne, (= *Photinia villosa D. C.*). From these experiments it was concluded that the *Gymnosporangium* living on the stems of *J. chinensis* has no genetic relationship with *Roestelia koreaensis*, but with *R. Photiniae* P. Henn (= *Gymnosp. Photiniae* [P. Henn] Kern), whilst the *Gymnosporangium* on the leaves of juniper judging from its morphological characters appears to be identical with *Gymnosp. Haraenum* Syd. Recently (1913) K. KARA has been able to establish by infection experiments, some resemblance between this *Gymnosporangium* and *Roestelia koreaensis*. K. MIYABE and G. YAMADA have observed that the germinative hyphae of the teleutospores of *Gymnosp. asiaticum* from the leaves of *J. chinensis* may penetrate the leaves of *Pyrus sinensis*, *Cydonia vulgaris* Pers. and produce the roestelia stage. There is nothing to dispute the identity, both morphological and biological, of *Gymnosp. Haraeanum* and *Gymnosp. asiaticum*. According to KERN's theory that each *Roestelia* belongs to a species of *Gymnosporangium* and that every specific name should be determined according to priority, then *Gymnosporangium japonicum* ought to be written as *Gymnosp. Photiniae* and *Gymnosp. Haraeanum* (= *Gymnosp. asiaticum*) as *Gymnosp. koreaensis*.

In damp places in Hokkaido there appears each year on the almost dead leaves of *Phragmites communis* Trin. the fungus *Napiculadium arundinacearum* (Cda) Sacc. This fungus was first recorded in Japan in 1909 by H. and P. SYDOW who had studied the material collected by I. MIYAKE in

the province of Izu. In 1910 MIYAKE described a new fungus *Brachysporium Phragmitis* found on the leaves of *Phragmites communis* at Pekin. Judging from the description and the figures, the writer considers this fungus to be *Napiculadium arundinacearum*.

482 – ***Plenodomus destruens*, "Foot Rot" of Sweet Potatoes.** — HARTER L. L. in *Journal of Agricultural Research*, Vol. I, No. 3, pp. 251-275, 1 Fig. + Pl. XXIII-XXVIII. Washington, D. C. 1913.

In August 1912 the writer received some diseases specimens of *Ipomoea Batatas* for examination from the neighbourhood of Dismal Swamp, Virginia. The base of the stems was covered with a fructification which appeared on superficial examination to resemble the pycnidia of *Diaporthe Batatatis*, the cause of "dry rot" of sweet potatoes (1). A careful examination of the material showed that the fructifications differed somewhat in structure from those of "dry rot" though the two forms evidently belong to the same group. At the end of the month the disease was found in all the sweet potato fields near Dismal Swamp where it caused a loss in the harvest of from 10 to 50 per cent. or even more.

In August 1913 the disease was recorded for the first time in several fields near Cape Charles and Keller. It is not known if this is its first appearance in this part of Virginia. The writer had inspected several fields in this zone during previous summers without observing the disease. It appears therefore that this disease is either new to the locality or has only previously existed in a very restricted area. The writer identifies the disease as *Plenodomus destruens*, which destroys the soft bark at the base of the stems thus causing the death of the plants. Pycnidia are formed in the diseased portions of the stem soon after the death of the plant.

The disease first appears on the stem and spreads to the tubers and branches. Artificial cultures may be grown on most media but the best development occurs on a maize or rice flour medium and on the stems of the plant. Numerous innoculation experiments have been made at Potomac Flats, near Washington, D. C., and also under glass with successful results, and the fungus has been isolated again from innoculated plants. It also attacks *Ipomoea coccinea*, but *I. purpurea* Roth. and *I. hederacea* Jacq. appear to be immune. Sweet potatoes in store are destroyed by the disease, if innoculated and exposed to the light in a damp atmosphere. These conditions have no effect on the development of fructifications in rice cultures. Its maximum development in pure culture is obtained in rice media at a mean temperature of 21.9 C. The disease survives the winter on the dead branches of the sweet potato and probably spreads by means of the seed tubers and the young shoots. For controlling the disease the writer recommends the sterilisation of the seed beds and a careful selection of the seed tubers.

(1) See No 1104, *B.* Sep. 1913.

483 – ***(Bacterium aptatum)* n. sp. Injurious to the Leaves of Sugar Beets and Nasturtium *(Tropaeolum)* in the United States.** — BROWN, NELLIE A. and JAMIESON, CLARA O. in *Journal of Agricultural Research*, Vol. I, No. 3, pp. 189-210, fig. 1-5, Plates XVIII-XIX. Washington, D. C. 1913.

This bacterial disease was observed for the first time in Autumn 1908 on the leaves of *Tropaeolum* (nasturtium) near Richmond, Virginia and on the leaves of sugar beets at Garland, Utah. The disease appears as leaf spots, and investigations during four years have shown that the organisms causing the disease are the same on both host plants.

The diseased nasturtium leaves gathered in the open appeared withered and discoloured and showed brown watery spots from 2 to 5 mm. in diameter. The leaves of sugar beet were received from Utah, California and also from Oregon in 1909 but at present the disease has not yet been recorded from other States producing sugar beets. The first leaves received from Utah showed spots and dark brown blotches, sometimes black, irregular in shape and from 3 mm. to 15 mm. in diameter on the petiole, the upper side and the mid rib. Accasionally the discolouration extended a short distance along the veins and the leaf tissue appeared brown and dry on both sides. Sometimes corky outgrowths appeared in the centre of the leaves. In badly diseased petioles the tissue was soft as though attacked by a " soft rot ". The symptoms differ from those produced by *Cercospora* and *Phyllosticta* which are limited to small areas.

Pure cultures of the organism are capable of producing the disease in either host (sugar beets or nasturtium) and also in the pods of haricot beans, lettuce, pepper and the egg plant. The parasite probably enters the tissues of the plant through wounds or as a result of insect attacks and is probably spread by means of insects. It differs from *Bacterium xanthochlorum*, parasitic on potatoes, and from *Pseudomonas tenuis*. It differs also from *Bact. Phaseoli* though both cause spots on the leaves and pods of beans. The writers describe this new organism as *Bact. aptatum* n. sp.

484 – **A New Chestnut Disease.** — CAVARA F. in *Rivista di Patologia vegetale*, Year VII, No. 1. pp. 1-5, 2 Fig. Pavia 1914.

In this preliminary note, the writer reports that he received, in the latter part of August 1913, a score of seedling chestnuts from the forest nursery at Sienna (Italy) in an advanced state of disease. The leaves were dried up, but not attacked by parasites and the buds fell off at the slightest touch. The young stems, measuring from 15 to 20 cm. were damaged near the tip and showed a shrinkage of the cortical tissues, whilst, near the base, in the region of the second internode, they were thickened and swollen. At the first node above the cotyledons there were excrescences or nodules accompanied by rupture of the periderm, and the remainder of the stem to the hypocotyl was one mass of disease. The periderm and cortex were destroyed, thus exposing the woody tissue of the stem as in the case of a vigne stem disease (" broussins "). The root system, however, shows no exterior changes or traces of disease. From a general examination of the material, the writer concluded that the disease was localised at the swollen portion of the stem and that is was due to a bacterium.

With the object of studying and identifying the disease, fresh material was obtained in good condition at the beginning of September from nurseries at Campino near Sienna, where the disease, though not so intense as in 1913, had attacked the seedlings of the preceding year. Owing to the frequent rains in June and July and to the heavy nature of the land, the disease accounted for the death of 16 000 plants in a short time.

From the excresences of these plants the writer has isolated an organism which differs from the well known *Bacterium tumefaciens* of E. F. SMITH (1). The parasitic nature of this organism still requires confirmation by innoculation experiments which will be carried out in the spring; meanwhile the writer describes the organism as *Bact. costanicolum* n. sp.

485 – ***Polyporus dryadeus*, Root Parasite of the Oak in the United States.** — LONG W. H. in *Journal of Agricultural Research*, Vol. I, No. 3, pp. 239-250, Pl. XXI-XXII. Washington, D. C. 1913.

Polyporus dryadeus Fries has been found on oaks in the forests of Arkansas (*Quercus alba L.*, *Q. velutina* Lam.) Eastern Texas (*Q. texana* Buckl., *Q. nigra* L.), Oklahoma (*Q. minor* [Marsh] Sarg.) Maryland (*Q. alba* L.) and Virginia (*Q. alba* L., *Q. rubra* L. and *Q. Prinus L.*). The disease is parasitic on the roots causing a rotting of the sap-wood and heart-wood. In all the cases examined by the writer these forms of rot do not extend higher up the tree than true rot of the trunk, but continue into the underground portions. The white rot of the heartwood of the oak and the fructification of the fungus described and figured by ROBERT HARTIG (*Die Zersetzungserscheinungen des Holzes der Nadelholzbäume und der Eiche*, pp. 124-128, Tab. 17. Berlin 1878) are connected with the fungus known in America as *P. dryophilus*.

The disease occurs chiefly on old trees, trees excessively pruned or growing under unfavourable conditions. It does not spread rapidly to adjacent trees, but is widely distributed in America and Europe and probably exists in every country where the oak grows.

INSECT PESTS.

GENERALITIES.

486 – **The Distribution of Gall Insects in the Flora of Milan.** — COZZI, C. in *Atti della Società italiana di Scienze naturali*, Vol. LII, pp. 514-536. Pavia, 1914.

The writer gives a list of 97 galls collected during 1911-13 in the plain of Milan (Italy) between Tessin and Olona and chiefly in the neighbourhood of Gallarate, the gall insects of which have not yet been investigated. The list includes 26 Diptera, 26 Hemisphera, 19 Acarinae, 18 18 Hymenoptera, 3 Coleoptera, 2 Lepidoptera and 4 gall insects probably new to science. The 65 host plants studied by the writer are distributed amongst 28 families and were represented largely by cultivated plants or by others useful to man.

(1) See No. 185, *B.* Feb. 1913. (*Ed.*)

487 – **On the Occurrence of *Aphis maidis* in West Africa** (1). — VAILLET A., in *Bulletin de la Société entomologique de France*, N. 3, pp. 116-117. Paris, 1914.

This insect which is well known as a parasite on maize in the United States, on sorghum (*Sorghum vulgare* Pers.) in Australia and also in Japan, has not been previously recorded in Africa. The writer has observed it during recent years at Koulikoro (Upper Senegal-Niger). In the French Soudan, *Aphis maidis* shows a marked preference for sorghum, but it causes less damage than *A. sorghi* Theobald, which sometimes prevents the cultivation of sorghum. It seems very probable that the insect occurs also in the Egyptian Soudan.

MEANS OF PTEVENTION AND CONTROL.

488 – **The Destruction of Insects Imjurious to Fruit Trees and Vines by Means of " Carragaheen " or " Pearl Moss " Jelly *(Chondrus crispus)*.** — JSSLEIB in *Zeitschrift für Pflanzenkrankheiten*, Vol. XXIV, Part 2, pp. 78-79. Stüttgart, 1914.

For the destruction of injurious insects, especially *Tortry* on vines and fruits, tree the writer recommends the use of " carragaheen " or " pearl moss " jelly (*Chondrus crispus*). About 2 lbs of the jelly are boiled with 10 gallons of water for about 1 hour, water being added to make up the loss due to evaporation. The gelatinous solution is filtered and sprayed on the plants or objects containing the eggs of the parasite. On drying, a thin film remains, which becomes detached as scales containing the eggs and larvae. Dry weather is essential for this method, otherwise the gelatinous liquid is washed away.

Various insecticides may be added to the solution such as 1 lb of nustard oil dissolved in 5 pints of alcohol to 100 gallons of the solution. The cost of this latter mixture would be about £1 per 100 gallons.

(1) See also No. 79, *B.* Jan. 1913. (*Ed.*).

RUGGERI ALFREDO, *gerente responsabile*.

FIRST PART.

ORIGINAL ARTICLES

Protective Inoculations against Swine Fever in Hungary

by

Prof. F. HUTYRA, *Budapest.*

Since the year 1896 when swine plague made its first appearance in Hungary, it has caused enormous losses every year amongst the herds of swine. During the first year it spread rapidly over almost the whole country and in the following year 639 765 deaths were officially reported. After that the losses decreased, but only because the stock of pigs had considerably diminished. The usual veterinary police measures proved quite ineffectual in checking the progress of the disease and many large estates were constrained either to reduce their herds or to suppress them altogether. This very unsatisfactory state of affairs began to improve when protective inoculations were recognized as a suitable remedial measure.

Following on the results of DORSET, Mc BRYDE and NILES, which showed that the American *Hog Cholera* was caused by a virus, similar experiments were carried out in Hungary and proved entirely confirmatory, as were those of workers in other countries, proving that the European swine fever is caused by the same virus and is identical with American hog cholera.

This led to inoculation experiments being undertaken, on the same plan as those of the American investigators, by the writer and Dr. J. KÖVES; these likewise showed that pigs which have survived an artificial or natural infection can acquire a high degree of immunity and that their serum then has the property of protecting other pigs against artificial or natural infection. The experiments were repeated on a large scale in 1908 ; as they yielded satisfactory results, the necessary arrangements were made for producing large quantities of the protective serum. A somewhat primitive State laboratory was equipped at the stock farm at Köbánya and was ready to distribute the serum in the spring of 1909.

The very first inoculations were successful and consequently the demand for the serum increased to such a degree, that the laboratory was scarcely able to meet it and it was found advisable to hand over the production of serum to a private company formed for the purpose, reserving the actual technical work concerned in the preparation to State officials, and submitting the company to State supervision. The laboratory was not moved, but considerably enlarged by new buildings and enclosures, the stock of pigs kept ranging between two and three thousand.

Hyperimmunisation is carried out as follows : pigs weighing about 220 lbs. and having already recovered from a slight infection, are subjected three or four times at intervals of about two weeks to subcutaneous injections on the belly. The infection consists of 300 to 400 cc. of virulent blood taken from pigs suffering from acute infection. About ten days after the last injection, blood is first drawn from their tails and finally they are bled to death by a wound in the heart. The blood obtained is immediately centrifuged and 0.5 per cent. of carbolic glycerin is added to the separated serum.

The following quantities of serum have been prepared since the foundation of the laboratory :

1909	622 839 cc.	used entirely in Hungary.
1910	1 947 095 »	
1911	3 736 710 »	the greater proportion used in Hungary.
1912	7 454 150 »	

Only serum that has been tested on animals and found effective is sent out. Table I shows the results of these tests on 104 six-months-old Mangalicza pigs averaging 64 lbs. in weight.

TABLE I. — *Tests of swine fever serum.*

Quantity of virus — cc.	Immunising serum			Number of animals	Deaths from swine fever	
	Quantity injected — cc.	Exp. Number (1)	Date when prepared		Absolute number	Per cent
			Control animals			
—	—	—	—	8	8	100.0
2.0	—	—	—	8	8	100.0
			Total . . .	16	16	100.0
			Immunised animals			
2.0	12.0	3/913	21. I. – 27. II. 1913	8	1	12.5
2.0	12.0	11/913	10. VI. – 21. VII. 1913	8	—	—
2.0	12.0	12/913	18. VI. – 16. VII. 1913	8	—	—
2.0	12.0	13/913	20. VI. – 31. VII. 1913	8	1	12.5
2.0	12.0	14/913	30. VI. – 9. VIII. 1913	8	—	—
2.0	12.0	15/913	10. VII. – 18. VIII. 1913	8	—	—
2.0	12.0	16/913	15. VII. – 1. IX. 1913	8	—	—
2.0	12.0	17/913	2. VIII. – 11. IX. 1913	8	—	—
2.0	12.0	18/913	22. VIII. – 13. X. 1913	8	—	—
2.0	12.0	19/913	12. IX. – 8. X. 1913	8	—	—
2.0	12.0	20/913	19. IX. – 14. X. 1913	8	1	12.5
			Total . . .	88	3	3.4

(1) Every Exp. Number refers to 44-88 gallons of mixed serum. The animals were kept in infected sties throughout the experiment.

Inoculation with serum produces only a temporary or *passive* immunity, but it has been found both in Hungarian and other experiments, that if the pigs which have been treated with the serum are exposed at the same time or shortly after to natural infection, they contract the disease in a mild form and acquire a permanent or *active* immunity. Consequently serum inoculation is only advisable in the case of already infected herds of swine, and should be practised as early as possible after the outbreak of the disease on all healthy pigs and on those that are not yet severely affected, after which the herd may be left till the total disappearance of the disease in the locality. An early diagnosis of the first cases and timely inoculation are essential in order to obtain favourable results from the serum. Unfortunately in practice, errors in diagnosis are not rare and inoculation is often delayed until the plague has already caused heavy losses and the herds are already badly infected, in which case secondary bacterial infections often set in against which the serum is powerless.

In the course of five years upwards of a million pigs have been inoculated with the serum in Hungary. Accurate reports from veterinary surgeons as to the results obtained from the inoculations practised on 110 198 pigs in 836 herds up to March 1,1914, have been received, and are summarized in Table II.

TABLE II. — *Results of serum inoculations in Hungary from April 1909 to March 1914.*

Inoculated herds		Inoculated animals		Limits of losses in inoculated herds	Total loss	
Number	Per cent	Number	Per cent		Number	per cent
408	48.8	35 738	32.4	0	—	—
156	18.7	32 734	29.7	0.1 — 5.0	667	2.0
75	9.0	12 176	11.1	5.1 — 10.0	886	7.3
81	9.7	14 096	12.8	10.1 — 20.0	2 236	15.8
720	86.2	94 744	86.0		3 789	4.0
37	4.4	5 410	4.9	20.1 — 30.0	1 270	23.4
46	5.5	5 699	5.2	30.1 — 40.0	2 140	37.5
33	3.9	4 345	3.9	40.1 and above	2 905	66.4
836		110 198			10 104	9.4

A reappearance of swine fever in herds that had been freed from it by inoculation was only rarely reported, and in these cases it is suspected that some other disease, such as swine erysipelas, was present. The permanent immunity of the animals treated with serum was also proved by thousands

of observations made on pigs, which, when hyperimmunised, were found to resist large quantities of virulent blood without any ill effect upon their health.

The experience gained in large fattening establishments is also instructive. In these cases the herds were inoculated immediately after the first appearance of the disease and suffered no appreciable loss, while formerly the havoc was almost always considerable. According to a report by Csáki, in one fattening establishment at Köbánya, 19 herds with 2478 pigs were inoculated in the course of two years, after which 185 head, or 7.5 per cent., had to be killed owing to severe illness. In the second year the losses diminished considerably and in three herds none were reported. On the other hand out of 150 pigs which were left as controls and not inoculated, 62, that is 41.3 per cent., fell victims to the disease. In 5 herds which were inoculated after some delay the losses ranged between 20 and 35 per cent. (altogether 144 head, or 27.5 per cent.). In eight other herds in the same locality, whose owners would not allow their animals to be inoculated, 804 pigs out of 1404, that is 53.8 per cent., had to be killed, the losses in the various herds ranging from 29 to 86 per cent.

As a result of this experience pigs, intended for fattening are generally treated with the serum shortly after being put into the fattening sties, and losses are thus avoided. Such is the confidence in the protective action of the serum that store pigs are now bought with impunity from ordinary herds, while formerly only such pigs were admitted to the fattening pens as came from herds having recovered from a slight attack of swine fever and which on that account could be considered as immune. Differences in the value and market price of the pigs according to their degree of natural immunity have consequently disappeared.

The permanence of the results of inoculation helped to spread the practice throughout the whole country, with the result that the swine industry has successfully recovered from a period of great depression and the number of pigs in the country has considerably increased.

The practical difficulty of obtaining an early diagnosis of swine fever followed by immediate serum inoculation of the herd, led to experiments being made several years ago on the so-called *immediate active immunisation* of healthy herds, a method which is preferred to serum inoculation in North America. It consists in the simultaneous subcutaneous injection of serum and virulent blood and it also presents some drawbacks, namely: 1) that the proportion of virus to serum to be used cannot be determined previously with exactitude, and consequently one can never be perfectly sure that the inoculation will not cause serious losses, and 2) that in this way previously healthy herds get the plague and may prove new centres of infection. On the other hand the simultaneous injections have the great advantage that they can be employed at any time and that only healthy herds are submitted to them, so that errors of diagnosis are out of the question.

A large number of practical experiments were undertaken in order to judge of the value of this method in Hungary. Herds of Mangalicza store pigs bought in different localities were placed on two large farms

and kept for several months in the open but separate from one another. The inoculations, which were always made by veterinary surgeons belonging to the laboratory, consisted in the subcutaneous injection of 1 to 2 cc. of virulent blood and 10 to 20 cc. of the serum. In almost all cases, after about a week well-marked reactions were observed: a certain number of the inoculated animals appeared less lively and ate their rations more slowly or not at all. These symptoms, however, usually only lasted a day, after which the animals got well again, with the exception of a few which grew worse and eventually died.

On one of the estates, between September 1910 and May 1911 ten herds comprizing 3163 pigs between the ages of 8 and 14 months and weighing 50 to 120 lbs. per head were inoculated. After an incubation period of 6 to 9 days, 467 head, or 14.7 per cent., fell ill and 73 head, or 2.3 per cent., died. With the exception of one herd, in which 6.2 per cent. of the inoculated animals died on account of a simultaneous outbreak of foot-and-mouth disease, the losses in the remaining herds kept below 3 per cent. After several months the pigs were fattened, and then in three herds 4.3, 2.0 and 11.6 per cent. of the pigs respectively contracted swine fever and had to be killed; the remaining herds suffered no loss.

On the second estate, at different seasons between July 1910 and February 1914, 45 herds with a total of 15394 pigs aged from 2 to 24 months were inoculated simultaneously with virulent blood and serum. Here also more or less violent reactions were obtained after about a week, but in the great majority of cases these caused only insignificant losses, as may be seen from the following table (Table III).

TABLE III.

Number of		Deaths	
Herds	Pigs	Head	Per cent
13	3 344	0	0
27	9 894	176	1.7
1	350	25	7.1
1	290	21	7.2
1	539	44	8.1
1	351	52	14.8
1	420	90	21.4

In the first year of this experiment new cases of disease and death appeared in 8 herds several months after the inoculation reaction (altogether 72 pigs out of 2802 animals, or 2.5 per cent.). As these cases were reported as swine fever it seemed as if they were the result of a retarded reaction, but further investigations proved them to be cases of swine erysipelas, where-

upon all such cases of subsequent disease were immediately treated with erysipelas serum; the result was that only 4 animals died in one herd of 476 pigs and none at all in the other 44 herds. Out of the 45 herds that were inoculated, 37 were put up to fatten partly in the same locality and partly at Köbánya and in no case were there any losses from swine fever. The permanence of immunity was also tested by the fact that in 7 herds, several weeks or months after the reaction, 245 pigs were infected artificially by subcutaneous injections of from 3 to 5 cc. of virulent blood, with the result that only one pig died and the others showed no signs of a reaction. Besides this, several herds were used later for the production of serum and with this object were treated with large quantities of virulent blood without suffering any loss.

The results obtained in Hungary during the last five years are in perfect accord with those obtained in North America, and show that swine plague can be successfully checked both by pure serum inoculations and by simultaneous injections. Serum inoculation is advisable for the treatment of recently infected herds and results in a rapid disappearance of the plague, provided the first cases are diagnosed soon after the outbreak and that the rest of the herd be inoculated immediately: in this case, owing to the simultaneous natural infection, they acquire a permanent active immunity. By the simultaneous inoculation with virulent blood and immunising serum the pigs get a direct active immunity. In quite healthy herds the simultaneous inoculations usually causes no losses at all or only quite insignificant ones, though there is no certainty that very violent reactions may not occur. Considering that animals thus inoculated secrete infectious virus during the period of reaction, precautions must be taken to prevent the possible spread of the disease to other herds.

The Cattle Industry in Italy at the Present Day

(*Continued from p.* 606)

by

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F. *Tuscany.*— The cattle in this region vary very much with the locality, but the most noteworthy breeds are the *Maremma*, the so-called *Mucca Pisana*, and especially the *Valdichiana*.

a) The *Maremma* is represented by the cattle found in the province of Grosseto and in a small part of the Pisa province; they are kept entirely or almost entirely on the pastures and present the characters of the *Podolian* type. They stand high with fore-quarters more developed than hind ones, their dewlap is abundant, their horns are thick and long, their coat is light or dark gray, darker on the fore than on the hind quarters and with black points. The cattle are semi-wild, hardy and

resistant; they are consequently especially suitable as draught animals, but of little or no value as producers of milk and meat.

b) The *Mucca Pisana* is met with here and there in Tuscany, but is especially frequent in the provinces of Pisa and Florence. Its coat is black or nearly so, and it is believed to be of Swiss origin. Some authorities are of opinion that other foreign breeds have also contributed to its formation. It is a fairly good milker and is also suitable for the production of meat and for draught purposes.

c) But among the Tuscan breeds the most prevalent and most important is the *Chianina* or *Valdichiana* breed, with its breeding centre in the Valley of the Chiana. Without entering into the question of its remote origin, which has been much discussed and is not yet settled, there is no doubt that this breed manifests some morphological characters belonging to the *Podolian* type. The animals stand high and have been called by LEYDER the giants of the species, the oxen measuring up to 6 ft. 4 in. Normal adult males in store condition weigh 1760 to 1980 lbs., cows 1320 to 1540 lbs.; at the Florence show of 1905 one fat ox weighed 2935 lbs., while cows can weigh up to 2200 lbs. These animals are unusually long-limbed; the coat is generally silvery white, with a tendency to gray about the neck and shoulders in all but the finest specimens, especially in bulls, and black points. The horns are rather short. The calves are born with a yellowish red coat which gradually turns white at between three and five months. Animals having pink spots on their tongues, muzzles, etc., or white hairs in the brush of their tails, are commonly called *mucchi* and discarded, such variations generally being hereditary and showing a tendency to albinism which is considered a sign of degeneration; *mucchi* are nevertheless markedly suitable for fattening. *Valdichiana* cattle are remarkable for their early maturity and fineness. They are both good draught animals and good meat producers, in fact with regard to this latter quality they can compete with breeds bred specially for the purpose. They fatten rapidly and kill well, yielding as much as 70.9 per cent. in carcase tests and never less than 60 per cent. Their strength as draught animals has been slightly reduced through the excessive refinement of the breed, so that they are now only used for haulage and agricultural work on the plains and on rather loose soils. As for milk, the cows barely produce enough to rear their own calves. The breed has been famous for a considerable time and has been studied and illustrated more than any other Italian breed. Of late years it has been the object of special attention on the part of distinguished scientists and enthusiastic breeders, amongst which Prof. EZIO MARCHI, Count PASSERINI of Bettolle (Arezzo) and the Counts of FRASSINETO (Arezzo) deserve to be mentioned. It has spread beyond the limits of its own district, not only in Tuscany itself but also in the Upper Tiber Valley, in Umbria and elsewhere.

G. *Marches and Umbria.* — These two regions being situated between Tuscany and Romagna on one side, and the Abruzzi and the Roman Campagna on the other, their cattle represent as it were an intermediate

stage between improved conditions of animal husbandry and its initial phases. Nevertheless, even here, marked progress may be recorded during the last few years. The inhabitants of the Marches classify their cattle into three groups which they consider as three distinct breeds.

a) The *mountain* breed, small and hardy animals, poor producers of milk and of meat, belonging to the *Podolian* type. On the high mountains pure *Maremma* cattle are frequently imported.

b) The so-called *plain* or *improved* cattle of the Marches, which is also called the *Perugia* breed, and which is the most important. It is the result of crossing the *Valdichiana* with the native cattle of the *Podolian* type, which was carried on during the second half of the last century. The Valdichiana characteristics which now predominate in this breed are somewhat too exacting for local agricultural conditions ; but the latter are gradually being improved and the infusion of some *Romagna* blood is also tending to adapt the cattle to their surroundings.

c) An intermediate breed is found on the hills, especially in the provinces of Ancona and Ascoli Piceno. It is the so-called *brina* or *marina* breed, and is the result of crossing the mountain and plain cattle. Gray in colour, but lighter than the mountain breed, it is smaller and more compact than the improved breed, being also coarser, hardier and very suitable for draught purposes.

In the country about Fermo and Pesaro a good many pure *Romagna* are bred and are daily becoming more popular in the Marches.

Umbria appears to have no distinct indigenous breed. The mountains are mostly stocked with *Maremma* cattle, and the plains and the valleys with *Valdichiana* or *Perugia* cattle.

H. *Latium, and the Southern Adriatic and Mediterranean regions.* — To the south of the Marches and Umbria the prevailing cattle all belong to the *Podolian* type, which undergoes various local modifications. Occasional imports of improved Italian or foreign breeds are met with, especially amongst dairy cattle near large towns, in which case the *Schwytz* are the most popular, though other breeds are also represented. The first imports of foreign cattle date back to early times. The Bourbons imported animals from Switzerland and from England, and traces of these are visible in the cattle of the neighbourhood of Naples and of the whole Sorrento peninsula. Of late years the imports have increased, not only to supply the city dairies with milk but also to improve the native cattle. The best results have usually been obtained with the Schwytz breed on account of its remarkable adaptablility.

The native *Podolian* or *Apulian* cattle are kept out on the pastures and receive no sort of attention unless environmental conditions make it imperative or unless the animals are required for draught purposes. They are allowed to breed promiscuously, or almost so, and this accounts for the lack of differentiated breeds, the local modifications which occur being due to natural external agencies.

The cattle of Latium, frequently called the *Agro Romano* breed, represent one of these modifications and are characterised by uniformity,

due to the relatively uniform conditions under which they live. They are above the average in stature, strongly built, with long thick horns and a rather dark gray coat.

The animals are very hardy, robust, almost wild and especially suitable for draught purposes.

Throughout the whole region it may be said that the cattle found on the hills are hardier, smaller, darker in colour, and produce less milk and beef than the cattle of the plains and valleys.

J. *Sicily.* — Animal husbandry occupies a very secondary position in the agricultural economy of Sicily, which is one of the poorest regions in cattle of all Italy. The number of stock, moreover, shows little sign of increasing, owing to the scarcity of keep. Cattle are kept almost entirely in the open, and only rarely housed.

Experiments have been made to introduce foreign breeds, especially in the neighbourhood of the large cities, but with indifferent success. Crosses have been attempted with *Schwytz, Simmental, Valdichiana* and even with *Dutch* and *Shorthorns*, but only the *Schwytz* have given good results.

The native or *Sicilian* cattle are usually divided into three sub-breeds:

a) The *coastal, plain,* or *Modica* breed which occupies the district of Modica and the western slopes of Etna.

b) The *Mezzalina,* or *hill* cattle, in the province of Trapani and the plain of Catania.

c) The *mountain* breed, found in the high mountains, as in the districts of Mistretta, Patti and Nicosia.

The *Modica* cattle are the most esteemed, and are most typical of the breed. They stand rather high (oxen up to 5 ft. 8 in). and three-year-old bulls weigh from 1320 to 1650 lbs. The coat is light or dark red — darker in the fore quarters and on the more exposed parts of the body — with black points; the horns are rather short, especially in the males, and black tipped; the dewlap is somewhat large, especially in the males. The cows have well developed udders. They are good draught animals and milkers, but not very suitable for meat production.

The milk yield varies considerably with the individual and with the season. In a good season when there is plenty of feed on the pastures, some cows will yield as much as 3½ to 5½ gallons of milk daily and even more during the spring and autumn; some cows are said to have given as much as 660 gallons of milk at one lactation, but during the summer heat the secretion of milk ceases.

The *mountain* cattle are small and very hardy; their horns are very long and their coat is a much paler red; they are strong and resistant, but are not good for the production of either milk or meat.

The *Mezzalina* sub-breed occupies an intermediate position both for size and other characters.

K. *Sardinia.* — Agriculture in Sardinia is prevalently of an extensive nature, based on the production of live stock and cereals. Livestock is of the greatest importance in Sardinia. Cattle especially are the chief source

of wealth and of recent years have both increased in numbers and improved in quality.

The old Sardinian is gradually disappearing, leaving in its place the improved breed which is becoming increasingly popular on the markets of the mainland. Only in the mountains and in out of the way places are those small animals still to be seen, which formerly were characteristic of the whole of Sardinia and which stand only about 4 ft. high and weigh under 550 lbs. Their coat is reddish or yellowish, with black muzzles, brown switches to their tails and brown rings round the eyes; their horns are long and thick, and their yield of milk and meat is very poor.

The present cattle is the result of repeated crosses with imported breeds. Bulls from Sicily, Piedmont, Lombardy, Tuscany and the Marches were first imported for the purpose, but of late *Schwytz* bulls have been preferred, and every year they are now imported on a large scale. The cattle have much improved with regard to size, early maturity and milk an meat production; at the same time, they are good draught animals, their live weight ranges from 1320 to 1760 lbs. These results have been obtained in spite of the very primitive conditions under which the animals are still reared.

From the foregoing account of breeds and their distribution, it is apparent that the cattle industry in Italy has undergone considerable development in recent times, and is likely to increase in this direction with the spread of education and of the cooperative spirit. Nevertheless, much remains to be done and a higher degree of production will hardly be reached in many parts unless State aid be granted to start the process of improvement.

Recent Experience and Progress in Beekeeping in Germany.

by

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Beekeeping in Germany had made satisfactory progress both in theory and practice, notwithstanding the unfavourable conditions of weather and of yield, which, during recent years, have diminished the returns of this industry.

The action of the State in establishing institutions for research and instruction, and the organisation of theoretical and practical courses of beekeeping, now held regularly every year in almost all the beekeepers' associations in the Empire, have largely contributed to the progress of beekeeping. Thus in Bavaria, which numbers about 50 000 beekeepers, a scientific institution for the study of bees has been founded at the University of Erlangen; here, elementary and advanced courses are held on beekeeping, bee diseases, the breeding of queens, etc., under the direction of Professor ENOC

ZANDER. This institution is under the general supervision of the Professor of Zoology, Dr. FLEISCHMANN.

The results of the scientific work of this institution have been published in the work of Professor Zander : *Handbuch der Bienenkunde in Einzeldarstellungen* (1). The yearly reports are published in the *Landwirtschaftliches Jahrbuch für Bayern* (2).

Every year scientific and practical courses for persons from all the confederated states are held at the Royal Horticultural Institution at Dahlem, Berlin. The scientific instruction is given by Dr. KÜSTENMACHER, professor of beekeeping in the institution, and other teachers (for chemistry, botany, etc.). The practical instruction is given by the writer of this paper or by other leading men of German beekeeping. The reports upon the work of the Institute appear regularly in the *Bericht der Königl. Gärtnerlehranstalt zu Dahlem bei Berlin* (3) (Report of the Royal Horticultural Institution of Dahlem near Berlin), made by the Director, Herr Oekonomierat TH. ECHTERMAYER.

The director of the Biological Institute at Dahlem, Dr. MAASSEN, occupies himself especially with the diseases of bees. It is to a great extent due to him that the etiology of foulbrood has been satisfactorily and scientifically explained ; on the basis of the results of his investigations a bill has been drawn op on foulbrood and other contagious diseases of bees, which will probably be discussed and approved by the Reichstag in the course of this year.

The Imperial Sanitary Office (*Reichsgesundheitsamt*) has published a memorandum on the honey trade, in which it warns German beekeepers of the danger that threatens them in the shape of cheap foreign and artificial honey, and communicates the measures adopted by the authorities and the decisions of the law courts for the protection of beekeepers and of the honey-consuming public. Dr. KUSTENMACHER published in the *Deutsche Bienenzucht in Theorie und Praxis* (4) year 1910, a series of articles with the object of explaining scientifically "what is honey", upon which the Reichsgesundheitsamt published an *Entwurf zu Festsetzungen über Hönig* (Draft of definitions of honey), which contains the preliminaries and bases for a law on the protection of honey demanded for many years past by German beekeepers. In consequence of the improvements in the methods of examining honey, due to the labours of Professor HAENLE of Strasburg, Dr. FIEHE of Berlin, Prof. LANGER of Graz, and others, it has become easier to distinguish with certainty between pure and mixed or adulterated honeys and to prove the kind and degree of adulteration.

As for the special questions connected with the study of bees, which during recent years have awakened most interest, we can in this short review only mention the more important.

(1) Published by Eugen Ulmer, Stuttgart.
(2) Published by Carl Gerber, Munich.
(3) Published by Paul Parey, Berlin.
(4) Published by Fritz Pfenmingstorff, Berlin.

The discussion as to the notion of the bee colony still continues. The anthropomorphic theory and the so-called organic theory oppose each other. The first considers the colony as a closed family (called also a State) of several individuals united for the purpose of conservation and reproduction, and who, in consequence of their special endowment and intelligence, are capable of adapting themselves suitably to the structure of their state and of finding out and fulfilling the special function which each has to perform. The other theory, that of the so-called organic point of view, which has been introduced and defended by us, considers the colony as a whole as a living unit, which, according to its wants for the conservation of the species, develops out of itself special organs in the form of different beings which form the colony. The various functions which are indispensable for the preservation of the whole are correspondingly distributed among its members according to their age and sex. The preservation of the colony is not based on the free choice of functions by each member, which presupposes a certain intelligence in the bees, but by the difference of the physiological structure of the individual members and of the whole colony, caused by the conditions of their life, from which arise the capacity for and necessity of the various forms of activity for the conservation of the whole, to the exclusion of the free choice of functions on the part of the individual. The organic point of view has found decisive scientific support from the recognition that certain organs develop and begin to function only at certain periods, and after having fulfilled their duties disappear again. It is known that the wax glands do not develop their full functional activity until about 8 days after the emergence of the young bees and then retrograde until they cease to act ; further, that the young nurse develops to its full perfection a gland which is only found at this stage, but which is necessary for the digestion of pollen, and that this gland gets atrophied as soon as the bee has passed the stage of nurse bee and has become a worker. This shows clearly that the most important functions for the preservation of the colony and of all its members are connected with the various ages and with corresponding physiological states and anatomical transformations. The organic theory recognizes logically a rigorous division of work, which *represents the real basis for all the measures adopted in the practice of beekeeping*. It adapts its methods as much as possible to the biological laws of the colony and endeavours to practise systematic beekeeping. The organic theory of the bee colony and its consequences for the theory and practice of beekeeping are treated *in extenso* in the book *Der Bien und seine Zucht*, 4th Edition (Berlin, Fritz Pfennigstorff).

The question of *parthenogenesis*, which has been so much debated during the last sixty years is again the subject of lively discussion. The most minute investigation into the eggs of bees has proved that the original opinion of Dr. DZIERSON is still scientifically well founded; according to his theory the male members (drones) issue from unfecundated eggs, while the female members (queens and workers) hatch out from fecundated ones. Dr. NACHTSHEIM of Munich has furnished scientific proof of this, while Prof. BRESSLAU of Strasburg has recognized and described the mechanism of fecundation.

Nevertheless, even these new discoveries fail to explain how the queen is capable of fecundating her eggs or not according to their destination.

On the *origin of the bee pap* which the young larvae get during the first four days of their development, no unanimity of opinion has been attained in spite of intense investigation. Professor ZANDER and others uphold SCHIEMENZ' views, according to which the nutriment proceeds from the glands of the head and thorax of the young nurse-bees. Dr. KÜSTENMACHER shares LEUCKHART-SCHÖNFELD'S opinion, namely that the chyle stomach produces the bee pap. The latter considers the chyle stomach as the seat of the production of propolis.

It is satisfactory to note that of late years eminent zoological scientists have turned their attention to investigations on bees, and one may hope that before long many obscure points will be cleared up.

Practical beekeeping in Germany has, during the last ten years, undergone far-reaching changes. The most striking is the change from the fixed (basket) or skep hives to the movable bar frame hive and in the latter from the system of hives having the opening behind to that with the opening above. Quite recently horizontal hives have taken the place of vertical ones, and lastly, large hives are used instead of small ones.

The completely changed conditions of the honey-bearing flowers, which have converted the districts in which formerly the honey was gathered late into early yielding districts, have led to fixed hives falling more and more into disuse and being now almost limited to the heaths. In East Prussia, where formerly only basket hives (Kanitz hive) were common, the so-called mixed system prevails, that is the Kanitz basket hive is used as brood hive and for winter quarters, while a large lift with movable bar frames is placed on it for the honey. In this way it is possible to obtain centrifugated honey without destroying the combs. Nevertheless, the new bar frame hives are continually spreading in East Prussia.

In 1880, at the meeting at Cologne, uniform dimensions for the bar frame hives, which are still frequently called Dzierzon or Berlepsch hives, were fixed upon, the so-called *German-Austrian standard* (8.79 in. wide by 7.29 in. high for half frames and 14.58 in. high for whole frames). It soon appeared that these dimensions were not favourable to the development of the colonies. The early collection of the honey demanded a numerous population already in May and June, to be able to utilize completely the season which was often very short . This was not, however, possible with the standard hive, except with much trouble and difficulty, by enlarging the brooding space and similar measures.

At the same time as the insufficiency of the standard measures was recognized, the discovery was made of the laws which govern the making of wax and of the brood cells, which was to prove of the greatest importance in the construction of hives (1). With the demand for more space for the development of the colony was added the one due to a better knowledge of

(1) See: *Grundgesetz der Brut-und Volksentwickelung des Biens*, sixth edition: Berlin, Fritz Pfenningstorff.

the nature of a colony, namely for *Space corresponding to the population.* Thus scientific dimensions were introduced into Germany during the last twenty years and they have given satisfaction throughout the country. They are the following: 15.75 by 9.84 inches or 155 square inches for the comb without the wooden frame, and nine such combs afford the colony a sufficient brooding space. These dimensions, wherever they have been applied with understanding, have given the best results, and it seems that their substitution for all the others will be only a question of time. It is hardly to be expected that these will ever be replaced by other dimensions, as with them the habitation of the colony is made according to its requirements. The colony itself ought to change before other dimensions could be considered suitable.

This systematic brood comb has been adopted in many systems of hives which formerly used the standard dimensions, as for instance the Berlepsch, the four-storied Liedloff, the Alberti, the German-American and other hives. Most modern hives are built according to these dimensions.

On the introduction of this modern system the influence of America was felt. Almost all the American forms of hives prefer the isolated position of the colonies in the open under a separate protecting roof, which naturally suggested the idea of handling the colony from above. This method at first seemed strange and unusual to German beekeepers, who mostly kept their colonies in bee houses and handled them from the back of the hive. The handling from above and the new dimensions encountered many difficulties, and had to struggle with much prejudice, but with time all hostility has been overcome. When, during the last five years, the horizontal hives became the fashion in Germany, the handling from above, which a short time previously was held to be impossible, began to be considered quite natural.

When the systematic dimensions were introduced the vertical hives were preferred, that is those with high frames. For countries without late honey these hives are even now the best form, as they oblige the colony to provide first of all the necessary store of food for the winter and to deposit it overhead, before bringing the beekeeper's share into the lifts. These hives, by their special build, prevent the pernicious practice of feeding with sugar and causing the degeneration of the bees.

Certain conditions of the honey crop (fir and heather honey, etc.) render it necessary to remove all the honey from the body box or to collect as comb-honey all that which cannot be removed by centrifugation. This is not easy with the vertical hive; consequently, by the side of the vertical hives, have been introduced the horizontal ones, in which the modern brood comb is simply laid on its side without altering its dimensions. It is advisable to build the horizontal hives with the frames at right angles to the side which bears the alighting board and entrance.

The horizontal hive induces the bees, without any effort on the part of the keeper, to deposit all the honey they collect in the lifts, whence it can be easily collected. This can cause the body box to be completely freed from

honey when the booty is not heavy and sometimes in very poor years it can even endanger the existence of the colony.

The more unfavourable the conditions of the supply of honey-bearing flowers, the greater must be the care bestowed on the bees in order to get satisfactory returns from them. We cannot enter more fully into the subject, which, besides, is treated in every modern work on beekeeping.

An unforeseen difficulty in the way of adapting beekeeping to the changed conditions in the supply of honey-bearing flowers arose by the introduction made some decades ago of foreign breeds of bees, which hybridized the native bees that were well adapted to their environment, and in most cases spoiled them. It became necessary to breed, by selection, a bee suitable to present conditions. This was no easy task, as it is not possible to select a particular male (drone) for the mating. The impulse to the scientific breeding of queens, from both the theoretical and practical points of view, came from America. Von Stachelhausen worked out several sure methods and introduced them into Germany by his book: *Der Bien und seine Zucht.* The Swiss also, under the leadership of Dr. Kramer of Zürich, have devoted much care to the breeding of queens, which at present awakens much interest in Germany and is practised with success.

The recent investigations into the laws of heredity have yielded new principles and methods in the selection of breeding stock and of breeding, so that at present methods founded on scientific bases can be employed to obtain, by means of selection, the desired qualities.

In conclusion, the following are some statistics concerning bees and honey. On December 1,1912, the total number of beehives in the German Empire was 2 619 891, the highest on record. East Prussia, Württemberg and Baden have had the greatest increases. The importation of wax amounted to 2952 tons, worth £409 500, the exports to 1 430 tons, worth £210 500. Duty was paid in 1912 on £129 360 worth of honey.

German beekeepers attempted in 1913 to unite all their associations into one in order to defend their interests vigourously, but they have not yet succeeded in the proposed unification.

SECOND PART.

ABSTRACTS

AGRICULTURAL INTELLIGENCE

GENERAL INFORMATION.

DEVELOPMENT OF AGRICULTURE IN DIFFERENT COUNTRIES

489 – **The Agricultural Conditions of Albania.** — SEDLMAYR, E. C. in *Wiener Landwirtschaftliche Zeitung*, Year 64, No. 31-32, pp. 279-280. Vienna, April 22, 1914.

Leaving out of consideration the mountain pastures, whose area is difficult to estimate, the area of the land available for agriculture in Albania is between 500 000 and 600 000 acres. The most extensive estates are situated in the large plains along the sea, while the best soils are in the mountain valleys of the large rivers.

The greatest landowner is the State, and the large estates of which it disposes are partly absolute State property and partly « mewkuf » and « vacuf », *i. e.* ecclesiastical property. The large private estates are in the hands of about five great families, each of which possesses from 100 000 to 150 000 acres of land. Medium-sized estates of about 500 to 1000 acres in extent are fairly common all over the country, while peasants' farms of about 25 acres are rare in the plains, but prevalent in the mountains.

The large estates, both State-owned and private, and many of the medium-sized estates are worked on the share system. The size of the farms (« tschiftlik ») depends upon the number of members in the farmer's family and upon the quantity of live stock he possesses. One-tenth of the grain crop (« dim ») goes to the State; of the remaining nine-tenths, one-third goes to the landowner, and the rest or six-tenths to the farmer. In southern and central Albania large tracts of country lie fallow or are merely grazed, owing to the scarcity of farmers; at present barely 20 per cent. of the whole cultivable area is being farmed.

Agriculture is still in its infancy, the only implements used for tilling the soil being a primitive wooden swing-plough and a harrow formed of a bundle of thorns. Only quite recently some of the very largest farms in the north have provided themselves with modern ploughs, hay balers

and a few other inplements. Regular rotations are unknown. The most common crop is maize grown continuously, while small areas are put to wheat, rye, barley and oats. In some places tobacco, flax, hemp and cotton are to be seen, and to the south of Skumbi also rice fields. The agricultural produce is chiefly devoted to the needs of the local population, for means of transport are not only insufficient, but also unsafe.

Live stock is rather more important than the raising of crops, but is also conducted on extensive lines. Stabling is almost unknown, the animals being kept on the open pastures until they are ready for the market. The horned cattle are represented by the so-called Illyrian breed, small animals rarely attaining a height of 3ft. 6in., yellowish brown, yellow or gray brown in colour and generally uniform ; the buffaloes often met with in the plains are more strongly built, larger and better developed. The native horse is small, hardy and very thrifty and is very suitable as a saddle and pack horse. Asses and mules, especially in the south, are not rare. In the mountains, sheep prevail, especially in the form of a kind of Zackel sheep which supplies the peasants with meat, wool and skins, as well as milk. Goats are kept ; throughout the country, but especially in the mountains, they are a fine, well-developed breed. Very fine poultry are also found in Albania, while in many localities bees are kept, but in a most primitive fashion.

Oil and wine making are important branches of agriculture, while amongst fruits quinces and pomegranates thrive very well, besides plums, apples and pears, and in the north walnuts are abundant.

The grazing lands are extensive tracts often covered with bracken or scrub ,or almost desert like with scanty herbage growing among the stones. At other times they are arable land allowed to fall back into pasture. Meadows are rare and only attain any importance in the north. Grass leys are quite unknown.

Forestry has been still more neglected than agriculture and live stock, and extensive tracts of forest have been spoilt or completely destroyed by injudicious management. It is only in out-of-the-way valleys in the high mountains that valuable forests still exist.

In conclusion, the writer points out that agriculture may flourish and develop in Albania provided that the numerous rivers of the country be utilized systematically for irrigating the extensive plains and for the production of electric power, and that the means of communication be improved, the conditions of ownership settled, and the working classes educated.

490 – **Agriculture in the Argentine Republic.** — HERMES, A., with the assistance of HOLTMEIER-SCHOMBERG, H. — *Berichte über Landwirtschaft*, published by *Reichsamt des Innern*, pp. VIII + 311, 48 tables and 17 maps. Berlin, 1913.

The writer discusses in the introductory chapters the geographical position, area, history, the orographic, geological and soil conditions, as well as the hydrography and climate of the Argentine Republic. He reviews also the conditions of its native population and immigrants, and of the means of communication, and then proceeds to a description of the agri-

cultural conditions of the country, from which the following data are extracted.

Agriculture in the Argentine is still very extensive in character and is especially characterized by a simple and very distinct division between the cultivation of the soil and animal husbandry. These two great divisions of agriculture exist side by side and each has its own sphere of action and its own means of accomplishing its work.

Cultivation of the soil. — The owners of the numerous large estates (" estancieros "), devote themselves almost exclusively to the raising of livestock ; they cultivate the soil only temporarily and then only indirectly by means of colonists' families and only with the object of improving the food supply for the stock, *i. e.* of producing forage, especially lucerne. The still unbroken areas to be put to lucerne, or worn-out lucerne fields, are broken up by the colonists and cropped with wheat on the share system. With the last cereal crop, lucerne seed, provided by the estanciero, is sown and the colonist pulls down his primitive mud hut and moves on to another part of the estate to repeat the same process. The colonist's agreement with the landowner is usually made in one of the two forms : " a medias " and " per tanto ". According to the former the owner generally takes half shares both in the outlay for certain items such as seed, reaping and threshing, and in the returns. According to the second system the " tantero " bears all the farming expenses and pays a small percentage of the gross returns to the landowner for the use of the land.

One of the chief causes of the great spread of the share system in the Argentine is the shortage of labour and its high price.

Besides this, the character of the seasons largely affects the demand for labour during the summer over the extensive agricultural tracts.

The cultivation of the soil, as has already been mentioned, is only an accessory object, and has naturally undergone later and slower development than animal husbandry, which has been the prominent feature from the beginning. Only where medium and small holdings are more prevalent, as in the old colonists' centres of the chief provinces, especially in Sante Fé, is there unmistakable evidence of mixed farming. The cultivation of cereals on a large scale by individual owners or by contractors is not very frequent.

Except during the earliest periods of development in the seventeenth and eighteenth centuries, when the Cuyo provinces of Mendoza, San Juan and San Luis provided not only Argentine and Chile but also Brazil with wheat flour, Argentine has until recently been dependent on foreign countries for her corn. It was only in the seventies of last century that the country developed from an importer of cereals into a cereal exporting country, and she has come to occupy one of the most prominent positions amongst such countries in an astonishingly short space of time.

The agricultural area of Argentine was 1 432 620 acres in 1872 and had become 50 306 693 acres in 1910; that is in barely 40 years it had increased more than thirty fold. While the area of the cultivated land in 1872 was only 0.19 per cent. of the total area of the country it attained 6.82 per

cent. in 1910, and, notwithstanding the great progress achieved, this latter figure shows the great future possibilities of agricultural development in the country. Development has been especially rapid since 1895. Between 1895 and 1909 the cultivated land increased fourfold and the development has been most rapid in the central provinces of Buenos Aires, Entre Rios, Santa Fé and Cordoba, the cultivated area of which is much greater than that of all the other provinces and territories put together.

The export of cereals is due to the unceasing spread of cultivation. At first imports rose with the rising exports and it was only in 1877 that the exports were surpassed by the imports.

Table I shows how the value of the exports of animal products were gradually exceeded by the products of the soil, till, in 1908, the latter amounted to twice as much as the former.

TABLE I. — *Value of exports of plant and animal products from Argentine for the period* 1896-1910.

Years	Plant products (1)	Animal products
	£	£
1896	8 563 085	14 003 079
1897	4 632 955	14 700 308
1898	8 475 799	17 347 820
1899	12 935 379	22 439 457
1900	15 341 406	14 145 990
1901	14 213 929	17 995 976
1902	13 534 012	20 754 090
1903	20 895 477	21 675 704
1904	29 844 630	20 917 973
1905	33 796 696	28 001 177
1906	31 299 088	24 644 730
1907	32 577 008	24 581 949
1908	47 980 018	22 854 396
1909	45 761 815	30 483 860
1910	39 046 835	31 964 539

(1) Exclusive of forest products.

Agriculture in Argentina presents a a rich variety of cultivated plants, as may be seen from Table II, which shows the increased area of the varions crops since the beginning of the seventies of last century, a period which may be considered as the starting point of the recent agricultural development in the country.

TABLE II. — *Increased acreage of various crops, 1872-1909.*

Crops	Cultivated area in acres.				Percentage of increase in the period 1895-1909
	1872	1888	1895	1909	
Wheat	(1) 180 627	2 015 021	5 064 951	14 422 690	+ 185
Maize	322 304	1 980 796	3 074 491	7 425 625	+ 141
Flax	84	?	357 112	3 596 919	+ 276
Oats	—	—	?	1 414 946	+ 1 382 (2)
Barley	4 233	?	134 857	148 293	+ 10
Lucerne	261 397	963 747	1 762 112	11 630 259	+ 560
Potatoes	5 834	?	52 100	119 882	+ 130
Pulse	9 254	?	51 401	64 248	+ 25
Wine	9 019	63 393	82 680	302 607	+ 266
Sugarcane	6 062	52 046	151 411	174 830	+ 16
Tobacco	8 552	?	39 031	23 591	+ 65
Cotton	996	30	2 172	4 295	+ 98
Earthnuts	5 901	?	33 298	29 530	— 13
Vegetables	—	?	58 216	93 901	+ 61
Trees in general	—	89 268	504 656	1 641 819	+ 225
Other cultivated plants	70 406	912 406	120 093	5 302 247	+ 4 315
Total cultivated area (3)	1 433 252	6 076 707	12 088 582	46 395 634	+ 284

(1) This figure is too low, since the provinces of Buenos Aires, Entre Rios and Rioja, for which no statistical data could be obtained, are not included.

(2) The acreage under oats was not ascertained in 1872 nor in 1888 and 1895. The calculation of the percentage of increase is based on an estimate made in 1896, according to which the area was 95 401 acres.

(3) These figures are taken from official returns.

The class "other cultivated plants" consists almost entirely of grass leys, which in the year 1909 amounted to 5 154 008 acres. Here also the increase has been very considerable since 1895.

The great extent of the Republic, embracing various climates, is the reason for the diversity of crops cultivated. Together with the common cereal and forage crops, vines and subtropical and tropical plants grow to perfection. The rapid and extensive spread of wheat, the chief Argentine cereal, in comparison with that of subtropical and tropical plants, is due not only to favourable natural conditions, but also to the excellent position, as regards means of communication, of the principal wheat belt (Central Argentine). The same is true within certain limits of maize and lucerne. In 1909 these three plants occupied more than two-thirds of the whole cultivated area of the country.

On the other hand the chief territory in which tropical and subtropical crops, such as cotton, tobacco and coffee, are raised, namely Northern Argentine, lies at a greater distance from the European market and is far less well provided with means of communication than the coastal zone. With the present opening up of the large northern belt, however, the cultivation of tropical and subtropical crops is sure to increase rapidly, as the natural conditions are decidedly favourable.

Sugarcane is very important in the Argentine. The economic organisation of the province of Tucuman, which is the chief centre of its cultivation, is based upon it. Jujuy and Chaco come next in order of importance, and, at a distance, Santa Fé, Corrientes, Santiago del Estero, Salta and Formosa. Vine growing is also important; whilst in 1872 the total acreage under vines was only 9016 acres, in 1888 it was 63 360 acres, in 1895, 80680, and in 1909, 302 509 acres. Between 1895 and 1909 the area under vines almost quadrupled itself. More than three-quarters of this area is situated in the provinces of Mendoza and San Juan, the former with 119 848 acres, and the latter with 119 680 acres.

Live stock in general. — Table III shows the developement of live stock in the Argentine between 1888 and 1908.

TABLE III. — *Head of live stock* 1888-1908.

	Year			Percentage of increase or decrease		
	1888	1895	1908	1888-1895	1895-1908	1888-1908
Horses	4 262 917	4 445 859	7 531 376	4.29	69.40	76.67
Mules and asses	430 940	483 369	750 125	12.17	55.19	74.07
Cattle	21 963 930	21 701 526	29 116 625	— 1.19	34.16	32.57
Sheep	66 701 097	74 379 562	67 211 754	11.51	— 9.64	0.77
Pigs	403 203	652 766	1 403 591	61.15	115.02	248.11
Goats	1 969 765	2 748 860	3 945 086	39.04	43.52	100.28

The province of Buenos Aires, by far the largest of all, possesses more than one-third of all the cattle, one-third of the horses and upwards of one-half the stock of sheep and pigs of the whole Republic. On the other hand it is the last but one of all the provinces with regard to its stock of mules and asses and the last of all for goats. As for the value of the live stock, the province of Buenos Aires owns more than half the total. It is followed by the provinces of Santa-Fé, Entre Rios, Corrientes and Cordoba. Among the territories La Pampa occupies the foremost position.

The live stock at present existing in the Argentine Republic has been greatly improved by the introduction of European blood. The number and value of animals imported for breeding purposes between the years 1880 and 1907 (1) is shown in Tables IV and V.

(1) Unfortunately no reliable official statistical data as to the imports of breeding stock before 1880 are available.

TABLE IV. — *Number of live stock imported into the Argentine Republic between* 1880 *and* 1907.

Exporting country	Cattle	Horses	Asses	Sheep	Pigs	Goats
England	14 477	3 102	352	65 947	1 945	—
France	583	1 580	112	1 184	3	4
Germany	153	120	—	3 327	12	—
Belgium	325	156	—	209	56	—
Holland	50	26	—	10	14	—
Spain	42	84	839	128	4	4
Italy	62	79	57	56	6	2
United States	169	28	9	504	161	—
Australia	—	—	—	125	—	—
Various	10	11	—	33	5	—
	15 871	5 186	1 369	71 523	2 206	10

TABLE V. — *Value of live stock imported into the Argentine Republic between* 1880 *and* 1907.

	Total value £	Average value per head £ *s* *d*
Cattle	796 330	50 4 0
Horses	344 640	66 9 4
Asses	32 821	25 19 5
Sheep	715 079	10 0 0
Pigs	19 617	8 17 5

The total value of the animals imported into Argentina between 1880 and 1907 amounts to upwards of £1 900 000, the greater part of this sum going to England as the chief purveyor of the best live stock.

Horse breeding. — For centuries breeding was left almost entirely to nature without any human interference. Natural selection produced the native Criollo horse, which was extraordinarily hardy and resistant. In the second half of the nineteenth century this primitive system of horse-breeding underwent a great and unfavourable change owing to the enclosure of pastures with the formation of "bretes" or corrals, to the ruthless decimation of the herds of horses for their hides and to the slaughter of thousands of the best and heaviest horses for the numerous tallow factories. On the other hand the importation of the best European breeds, which commenced in the second half of the nineteenth century and increased rapidly, had a lasting effect and considerably modified

the Criollo horse. Vast tracts of country are now stocked no longer by pure Criollos, but by heterogeneous crossbreds, compared with which the number of pure-breds raised on the most up-to-date estancias is relatively small.

Thoroughbreds are the only type of light horse which has acquired a real importance in the Argentine Republic, owing to the passionate interest taken by the population in horse racing. No other country has invested such considerable sums in Thoroughbreds in so short a time. Amongst the other breeds of light horses introduced into the country, Hackneys undoubtedly take the lead. They are bred now with the greatest care in a number of the best estancias. From a purely zootechnical point of view their acclimatisation has been one of the most successful in the Argentine ; nevertheless their popularity has never spread and their distribution today is purely localised and confined to the neighbourghood of the great metropolis, Buenos Aires. The other types of light English horses, Yorkshire and Cleveland, have not acquired any special importance in the Argentine. The Anglo-Normans, which have been imported of late years in fairly large numbers, deserve to be mentioned, as they seem to be steadily gaining favour. Other types of light horses have also been imported, such as Hunters, Morgans, Russian and American trotters, Arabs, and, among German breeds, Trakehners, Oldenburgers, Holsteiners, and East Friesians, but without great success up to the present, owing in part to the fact that the experiments are very recent.

Among heavy draught horses, Clydesdales and Shires, the former especially, have long been most popular, but of late Percherons have become serious rivals and have gained much ground in a surprisingly short time owing to their general usefulness and to the good results they have given when crossed with the native breed. Of late years too the English Suffolk Punch has been tried, not without success, and quite recently the Boulonnais, French brother of the Percheron, has been introduced and promises to become popular. The Belgian breed has only been tried to a limited extent, but has so far given satisfaction and it appears destined to play an increasingly important part in the agriculture of the Argentine.

Cattle. — Of all the branches of animal husbandry none has taken the same advantage of the astonishing economic development of the country as cattle rearing. The second half of the nineteenth century with its extensive imports of the best European breeds and gradual elimination of the native Criollo strain represents a period of the great transformation in the Argentine cattle. In the case of cattle also, England is the great purveyor of improved stock, the part played by other countries being insignificant. The supremacy of England as a source of supplies is ensured by the special Argentine National Law, No. 4155, completed by some decrees, especially those of January 9 and 16, 1903, which forbid the importation of cattle, sheep and goats from any other European country.

Of all breeds the Shorthorn, or, as it is generally known in the Argentine, the " Durham ", is the most widely spread. It is especially suitable for crossing with the native Criollo cattle and is considered now as the impro-

ver *par excellence* of the Argentine cattle. The next in favour, but making a bad second, is the Hereford, which, in spite of great exertions on the part of its partisans, is in no great demand.

The third English beef type is the Aberdeen Angus, representatives of which are not very numerous and mostly met with in the south-western district. Perhaps this breed will spread more when the herds of the country are further improved so that it has a chance of revealing its great quality of producing valuable beef animals when crossed with other pure breeds.

No other breed has hitherto acquired any importance in the Argentine, neither the small English beef types nor milch cattle, the latter probably on account of the edict prohibiting the importation of cattle mentioned above. Among the best known milk breeds, Flemish and black and white Lowland cattle have been in the country for the last twenty years; Jerseys and Ayrshires have not become very popular owing to their lack of size and weight. The beef-producing types are by far the most prevalent, and give the cattle of the country a character of great uniformity. Argentine, with its great estancias and its herds running into thousands of head, is eminently adapted to the production of fat beef on its immense pastures.

Sheep. — The importation of improved European sheep began in the first half of the nineteenth century. The first object being to obtain a finer wool, imports from Spain were gradually abandoned in favour of imports of improved sheep from Germany, because breeders in that country have from the beginning devoted themselves to the production of fine wool. In 1836 and 1837 about 4 200 Saxon Elector and Negretti sheep were imported from Germany alone. At first the Electors were the most popular, but, owing to the lack of development of the crossbreds, after 1838 preference was given to Negrettis, which are larger and produce more wool, Germany continuing to be the chief source of supplies. Rambouillet sheep made their first appearance in the country in 1845, but it was only in 1870 that France caught up and passed Germany as a source of supplies, without however attaining very high figures. Vermont sheep were also tried, but without much success. The repeated severe crises in the wool trade, and the enormous increase in the number of sheep led the estancieros to seek to make sheep farming more profitable by utilizing skins and tallow in the " saladeros " (salt meat factories) and " grasieras " (tallow factories). Consequently size and condition of the sheep became more important and the larger and heavier Rambouillet breed was preferred. Meanwhile the increasing exports of live animals and frozen meat, together with the fact that even the somewhat coarser wool of the crossbreds found a sale on the markets, led to a demand for sheep which produced good mutton. In this way English breeds gradually replaced the fine-woolled types of France and Germany, and imports of these breeds soon became considerable. While England had exported to Argentine only 625 sheep for breeding purposes between 1863 and 1880 against 3269 from France and Germany in the next five years, 1881-85, the English sheep numbered 2759 against 1895 French and German.

Lincoln sheep were the favourites and were largely employed for crossing with Merinos, so that after a few years their crosses formed the bulk of the Argentine flocks ; they stocked the rich natural pastures in the province of Buenos Aires, while the Merino sheep were driven into the dry lands of the Central Pampas and of the south. There are still some first class Merino farms in the province of Buenos Aires, but the mass of Merinos are now in the above districts. From the Central Pampas the Merinos have spread gradually southwards to the Rio Negro, Santa Cruz and Patagonia. The common Merinos thrive especially well in Patagonia, which has become an excellent sheep raising country of late years, but which can only attempt to produce very high class wool on account of its great remoteness and consequent transport difficulties.

Romney Marsh sheep are at present found only to a limited extent, but seem to have a future before them in the Argentine. New Leicesters, Cotswolds and Cheviots have also been imported, but have not attained any importance ; neither have the Down breeds made much progress, probably owing to the coarseness of their wool.

Pigs. — Pig rearing is still in its infancy in the Argentine owing to the present conditions of land tenure and to the small and uncertain market. It is relatively more developed in the more densely populated agricultural districts, especially where much maize is grown.

Goats. — Goats are not numerous in the Pampas, owing to the predominance of sheep. They are more important in the mountainous parts of the Republic where they often represent a valuable source of income for the small farmer. Their most remunerative product is their skins, which command good prices, especially the kid skins.

Poultry. — Poultry keeping is also in a very undeveloped condition in the Argentine.

In a special chapter the writer treats of the work of the " Sociedad Rural Argentina " (the Central Agricultural Association of the Argentine) and of the International Agricultural Exhibition of 1910. A further chapter is devoted to the utilization of animal products in the Argentine (salting of meat, exportation of live animals and cold storage).

Utilizition of animal products.— At present the production of cold stored and frozen meat are the most important methods of utilizing animal products.

In 1882 Drabble Bros. erected the first cold storage plant in the Argentine, and were soon followed by Sausinena and Son. At first only mutton was treated, beef coming later. Exports began in 1883 with the limited figure of 17 165 head ; in 1885 the number was 108 823, in 1886, 434 699 and three years later it was upwards of a million. Since then the industry has developed rapidly, having been much assisted by the State.

At present the cold storage industry in the Argentine employs upwards of 7000 hands, and its working capital amounts to about £ 10 000 000. While in 1887 the value of the salted meat was 48 per cent. of that of the total quantity of animal produce exported, twenty-three years later it sank to less than 2.5 per cent. On the other hand cold-stored beef, which was ninth

on the list in point of importance in 1887, now occupies the first place. In the place of jerked beef (tasajo) more valuable products have appeared and the total value of exports has risen uninterruptedly and sometimes with great rapidity.

The price of refrigerated and frozen meat delivered on board at Buenos Aires is as follows :

	Price per lb.
Frozen beef	2.83 *d*
Refrigerated beef	3.37 »
Frozen mutton	3.79 »
Freight to London and Liverpool:	
Frozen meat	0.37 »
Refrigerated	0.51 »

Dairying. — The total number of dairying firms in the Argentine has risen from 324 in 1903 to 896 in 1909, but the whole industry is still in its early stages. Really intensive dairying does not yet exist and cannot exist, the large open grazing tracts and the lack of suitable labour as well as the thin population making the country in its present condition unsuitable for the development of the industry.

The milch cows are mostly crossbred Shorthorns and are milked in a rather primitive fashion, often only once a day, in the morning after they have suckled their calf. The yield of milk is low, at most 1.54 to 1.76 gallons during the first period of lactation and 0.44 to 0.66 gals. per day on an average. Breeding for milk is as yet scarcely known in Argentine, and would be hardly justifiable at present.

Of late the Government has seemed disposed to pay more attention to the question of dairying, and the recently founded " Oficina de Industria Lechera y Refrigeracion," which forms part of the Ministry of Agriculture, is beginning to show much activity. On its initiative the first milk control association has been instituted at Germania (" Sociedad de Contralor de la Produccion lechera de Germania ") with help from the River Plate Dairy Company (a large company of English and Argentine capitalists), which possesses in the provinces of Buenos Aires, Santa Fé, Cordoba and Entre Rios 45 creameries driven by steam and a capital of 500 000 pesos gold (£ 102 940). It makes butter, cream, and casein, and raises pigs in the butter factories (mantequerias) of Buenos Aires, Rosario, Santa Fè and Basavilbaso (Entre Rios).

A concluding chapter contains a description of typical farms and an extensive bibliographical review is given in the form of an appendix.

AGRICULTURAL SHOWS AND CONGRESSES

491 – **Agricultural Shows.**

Belgium.

1914. Oct. 24-26. Louvain. — Second International Poultry Show, organized by the " Aviculteurs de Louvain ".

France.

1914. Oct. 1-4. Angoulême. — General show of horticultural products and of the arts and industries depending on horticulture, organized by the "Société d'Horticulture et de Viticulture de la Charente ". M. Lotte, 98 rue de Bassau, Angoulême.

Dec. (2nd half). Paris. — Twenty-fifth Poultry Show of the "Société nationale d'Aviculture de France".

Germany.

1915. (Summer). Breslau. — Annual show of the German Agricultural Society (Deutsche Landwirtschafts-Gesellschaft).

March 19-21. Magdeburg. — Third fat stock show; will include also rabbits, agricultural machines, butcher's tools and foodstuffs.

Hungary.

1914. September. Budapest. — Show of agricultural machines, organized by the "Köztelek" Agricultural Society of Budapest.

Norway.

1914. Sept. 20-28. Christiania. — Exhibition of agriculture, mechanical cultivation and domestic economy, held during the Norwegian Centenary Exhibition (May 15-Oct. 15).

Russia.

1914. Sept. 18-Oct. 4. Rostov-on-the-Don. — Agricultural and industrial show, organized by the Imperial Agricultural Society of the Don-Kuban-Terek.

Spain.

1914. July-October. Tortosa. — International Exhibition of Agriculture, Viticulture and Hygiene.

492 – **Agricultural Congresses.**

France.

1914. Nov. 3-6 (probable date). Melun (Seine-et-Marne). — Nineteenth Annual Congress of Chrysanthemists, held by the "Société française des Chrysanthémistes". At the same time the "Société d'Horticulture de Seine-et-Marne" will organize a show of all horticultural products.

Dec. 4-5. Paris. — First National Congress on Agricultural Labour, organized by the "Société nationale de protection de la main-d'œuvre agricole." There will be six sections: 1) Legislation on rural wages and insurance. 2) Popular agricultural instruction. 3) Credit on property, housing, hygiene. 4) Labour exchanges. 5) Minor agricultural industries. 6) Métayage and various lease contracts.

Italy.

1914. August (end). Genova. — International congress on the wine trade, held by the local committee, in agreement with the presidency of the International Committee on the Wine Trade (Paris). There will be two long excursions, one to the vermouth districts and the other to Marsala.

CROPS AND CULTIVATION.

493 – **Determination of Air Temperatures.** — HELLMANN, G. in *Bericht über die Tätigkeit des Königlich Preussischen Meteorologischen Instituts im Jahre* 1913, pp. 46-51. Berlin, 1914.

AGRICULTURAL METEOROLOGY

Two aspiration thermometers (Aspirationsthermometer) were set up 1.5 metres (5ft.) apart in a meadow belonging to the Meteorological Observatory at Potsdam. One was one metre (3 ft. 3 in.) from the surface of the grass, which was kept closely mown, and the other was two metres (6 ft. 6 in.). Readings were taken by means of a telescope every second, usually for periods of ten minutes. From the results obtained, the writer drew the following conclusions:

1. On days of active radiation, the temperature of the air at midday may vary from 1° to 1.5° C. (1.8° to 2.7° F.) per minute at a distance of one and two metres from the surface of the soil. Changes of 0.4° or 0.5° C. (0.7° or 0.9° F.) in 10 to 15 seconds are not infrequent.

2. Variations of temperature during the hours of strongest sunshine (*i. e.* 7 a.m. to 1 p.m.) are greater at one metre from the surface of the ground than at two metres.

3. Usually during those hours, the temperature is higher at one metre than at two metres from the surface, but frequently this order is reversed, showing the presence of both ascending and descending currents of air.

4. In the early part of even hot days in summer (7 a.m. to 9 a.m.) large variations are rare, and during the colder months of the year the thermometer hardly varies 0.05° C. in several minutes.

It follows from the above conclusions that a single reading on days when radiation is very active is likely to give erroneous results and should be replaced by the mean of a large number of readings taken at frequent intervals. On the other hand one single reading will be sufficient on cloudy or windy days. Further, two metres is a better height at which to place thermometers than one metre, as violent fluctuations of temperature due to radiation and reflexion from the soil are less noticeable at two metres than at one. It would appear, therefore, that the English practice of placing thermometers at 4 feet from the surface of the ground would not give such good results as that observed in other countries of placing them at 6ft. 6 in.

494 – **Chemical Composition of Rain in South Africa.** — JURITZ, C. F. in *The South African Journal of Science*, Vol. X, No. 7, pp. 170-193. Capetown, March 1914.

These determinations of the chemical composition of rain in South Africa were begun in 1910 as part of the scheme for the examination of

TABLE I.

Locality	Period	Total rainfall in inches	Pounds per acre			
			Nitrogen			Chlorine
			as ammonia	as nitrates	total	
Grahamstown .	Aug. 1911 to July 1912	26.59	1.030	0.726	1.756	23.38 (1)
»	Dec. » to Nov. »	22.14	0.858	0.735	1.593	23.63 (2)
Kokstad . . .	Jan. 1912 to Dec. »	26.54	1.118	0.670	1.788 (3)	—
Bloemfontein .	Sep. 1910 to Aug. 1911	27.82	3.658	1.620	5.278	6.72
»	Sep. 1911 to Aug. 1912	15.49	4.870	1.363	6.233	2.31 (4)
Durban. . . .	Jan. » to Dec. 1911	42.34	3.651	1.234	4.885	61.16 (5)
»	Jan. 1912 to Dec. 1912	31.07	3.906	1.249	5.155	70.40
Cedara	» » » » »	26.68	4.710	0.865	5.575	16.17 (6)

(1) Not including Aug. and Dec. 1911, and May 1912. — (2) Not including Dec. 1911, and May and Aug. 1912. — (3) Excluding 0.25 inch of rain during Sept. 1912. — (4) Not including March 1912. — (5) Excluding 0.2 inch of rain during June 1911. — (6) Excluding 0.1 inch of rain during June 1912.

rainfall in all parts of the world initiated by Dr. MILLER. The determinations were carried out at 8 stations, adopting uniform methods of collecting and analysing the rainwater. Precautions were taken to prevent contamination by dust and by the excreta of birds.

The results obtained are summarised in the tables (I and II):

TABLE II. — *Comparison of nitrogen content of summer and winter rains.*

Locality	Period	Nitrogen in pounds per acre					
		Summer: Sep. to Feb.			Winter: March to Aug.		
		as ammonia	as nitrates	total	as ammonia	as nitrates	total
Grahamstown.	Sep. 1911 to Aug. 1912	0.592	0.465	1.057	0.448	0.264	0.712
Bloemfontein .	» 1910 to » 1911	1.425	0.907	2.332	2.233	0.713	2.946
»	» 1911 to » 1912	3.244	1.077	4.321	1.626	0.286	1.912
Durban. . . .	» » » » »	2.739	0.780	3.519	1.796	0.295	2.091

Table II shows an increase of nitric nitrogen during the summer months. During 1910-11 considerably more nitrogen was brought down as ammonia at Bloemfontein in winter than in summer, but during the following year this irregularity disappeared.

495 – **The Red Clay Soil of Porto Rico.** (1) — GILE, P. L. and AGETON, C. N. — *Porto Rico Agricultural Experiment Station, Bulletin* No. 14, pp. 1-24. Washington, March 1914.

SOIL PHYSICS CHEMISTRY AND MICROBIOLOG

The red clay is one of the most widely distributed types of soil in the island of Porto Rico. It is a fairly heavy clay resting on an impervious subsoil, and contains a high percentage of iron and aluminium but no carbonates, being almost invariably acid and deficient in organic matter. Usually it responds to manuring and more especially to applications of lime, but certain areas, which have been continuously under sugarcane, are in a "sick" condition and respond neither to manuring nor to liming. The reason for this condition is unknown, and the results of analyses of the organic matter of these soils carried out by the U. S. Department of Agriculture failed to account for the observed facts.

496 – **Methods in Soil Bacteriology, VII: Ammonification and Nitrification in Soil and Solution.** — LÖHNIS, F. and GREEN, H. H. (Laboratorium für Bakteriologie am Landwirtschaftlichen Institut der Universität Leipzig) in *Centralblatt für Bakteriologie etc., II Abt.*, Vol. 40, No. 19/21, pp. 457-479. (Article written in English). Jena, April 4, 1914.

In a series of ammonification trials the influence of aeration on the process was investigated by using different depths of liquid medium, blood meal being the basis of the nitrogen supply. It was found that this factor had less importance than was expected, and that the low ammonification

(1) See No. 100, *B.* Feb. 1914.

of substances in deep layers, such as has been previously noted, could only be due in part to the anaerobic conditions prevailing. In a second set of trials, the decomposing material was not only placed in a liquid medium but also distributed over various solid media, such as soil, sand, glass sand, glass wool, and this factor of distribution appeared to be of considerable importance, as ammonification was always more active when solid media were employed than it was in a liquid medium.

Nitrification trials showed that the activity of this process in liquid media decreases as the depth of the medium increases, and when the solution was spread out in a film 2 mm. thick, the results were similar to those obtained when soil was used as medium. The concentration of the ammonia in the liquid medium appeared an important factor, equal amounts of nitrate being formed with 0.1 per cent. ammonium sulphate and 0.1 and 0.3 per cent. magnesium ammonium phosphate ($Mg\,NH_4\,PO_4$) but the amount being reduced when 0.2 per cent. ammonium sulphate was used. The presence of basic magnesium carbonate proved distinctly inhibitive.

497 – **The Absence of Nitrate Formation in Cultures of Azotobacter.** — KELLERMAN, K. F. and SMITH, N. R. (U. S. Department of Agriculture, Washington, D. C.) in *Centralblatt für Bakteriologie etc., II Abt.*, Vol. 40, No. 19/21, pp. 479-482. (Article written in English). Jena, April 4, 1914.

Recently there has appeared a report (1) of observations upon certain cultures of species or varieties of Azotobacter recording the formation of nitrate, presumably resulting from the activity of the cultures under discussion. Professor Jones supplied the writers with cultures of four strains which he considered to possess the ability of forming nitrate ; these were grown in Ashby's solution both with and without the addition of potassium nitrate, and at stated intervals careful examinations were made both for the presence of nitrate and for the gain in total nitrogen due to the fixation of atmospheric nitrogen. The results indicated clearly that while these strains were capable of fixing appreciable quantities of free nitrogen they were apparently unable to produce nitrates.

498 – **The Mechanism of Denitrification.** — HULME, W. (Manchester University), in *Journal of the Chemical Society*, Vols. CV and CVI, No. 617, pp. 623-632. London, March 1914.

Four flasks of culture media were prepared, containing respectively :

1	2	3	4
Peptone . . 0.5 %	Peptone . . 0.5 %	Peptone . . 0.5 %	Peptone . . 0.5 %
Meat extract 0.5 %	Meat extract 0.5 %	Dextrose . . 0.5 %	Dextrose . . 0.5 %
Pot. nitrate . 0.5 %		Pot. nitrate . 0.5 %	

and were inoculated with pure cultures of denitrifying organisms isolated from dried sewage filter deposit. The gases formed by the fermentation

(1) JONES, D. H., A morphological and cultural study of some Azotobacter. — *Centralblatt für Bakteriologie, II Abt.* Vol. 38, pp. 14-25, 1913.

were collected, measured and analysed. After 20 days they had the following composition:

Flask	cc. of gas formed	Hydrogen %	Nitrogen %	Carbon dioxide %
1 Containing nitrate	39	—	98.83	3.17
3 Containing nitrate	36	—	98.59	1.41
2 Containing no nitrate	26	70.14	—	29.86
4 Containing no nitrate	53	73.17	—	25.83

Flasks 1 and 3 were also shown to contain nitrite.

From these results it would appear that reduction of nitrate is brought about by the action of nascent hydrogen, for though hydrogen is the chief constituent of the gas evolved from flasks 2 and 4, which contain no nitrate, in the presence of nitrate the gas of fermentation consists almost solely of nitrogen. This conclusion was confirmed by another experiment in which the medium fermented contained a weaker solution of nitrate (0.1 per cent.). So long as nitrite was present in the fermenting solution the gases formed consisted of nitrogen and carbon dioxide, but as soon as reduction was complete and nitrite could no longer be detected in the fermenting solution, then the gases formed consisted of hydrogen and carbon dioxide.

In order to determine whether enzymes played any part in denitrification, sterile enzyme solutions were prepared from the four above culture media. The media were precipitated with alcohol and salt, and the precipitate was dried, redissolved, and filtered through a Chamberland filter candle. A few cc. of these enzyme solutions were then added to tubes containing 5 cc. of a 1 per cent. solution of potassium nitrate and incubated for 24 hours, after which the nitrate present was estimated quantitatively:

Flask	Mgm. of nitrogen as nitrite		
	Nitrate sol. alone	Enzyme sol. alone	Nitrate + enzyme sol.
1	0.005	0.01	0.03
3	0.005	—	0.02
2	0.005	—	0.01
4	0.005	—	0.01

These results seem to show that the denitrification of a medium containing nitrates and peptone under anaerobic conditions yields an enzyme

which has the power of reducing a 1 per cent. solution of potassium nitrate. The reduction obtained with the enzyme solutions from flasks 2 and 4 was probably due to a purely chemical reduction of the nitrate by the organic matter present in the solution.

Further enzyme solutions were prepared from a nitrate broth undergoing denitrification: *a*) after the fermentation had progressed for four days and the culture medium contained a considerable quantity of nitrite, and *b*) when the fermentation was complete and all the nitrate and nitrite had been decomposed; both were tested for enzyme action as before and the results showed that the denitrification of nitrate broth under semi-aerobic conditions involved the production of an enzyme as long nitrate or nitrite were present in the solution, but that the enzyme disappeared when the nitrate and nitrite had been decomposed.

Finally, other enzyme solutions were prepared from culture media, some of which had been inoculated with denitrifying organisms while others had remained sterile, in order to determine whether the reducing product isolated from denitrifying solutions was really due to bacterial influence, or whether it would also be produced in a flask containing similar ingredients and treated in exactly the same way, but which all the while remained sterile. The enzyme solutions were tested as before and the results definitely showed that the reducing product was due entirely to bacterial action and was not a purely chemical product.

499 – **The Functions of the Non-Bacterial Population of the "Bacteria Bed."** — CRABTREE, J. (Manchester Sewage Works, Withington) in *Centralblatt für Bakteriologie Abt. II*, Vol. XL, No. 11/13, pp. 225-239. Jena, March 2, 1914.

Three experimental contact filter beds were prepared as follows: the socket ends of three earthenware sewer pipes, 2ft. 6in. long by 6in. in diam., were filled with concrete to form a bottom, and a hole was bored at the base of each to form an outlet. They were then filled with clinker, 0.25 in. to 0.75 in. in size, and received the effluent from the settlement tank twice daily except Saturdays and Sundays when only one filling was given; the contact lasted two hours each time. Of the three beds, A served as control, B was subjected repeatedly to partial sterilization by filling the tank with a saturated solution of toluene in water, and C was at first run as a duplicate of A but later was also toluened. The beds were occasionally, and the effluents constantly, subjected to analysis, chemically by the estimation of free ammonia and nitrates and by the oxygen absorption test, and biologically by the plating out of bacteria on gelatine and by counting protozoa by means of a plankton counting chamber. Further, a preliminary set of experiments showed that the bacterial content of the effluent varied with that of the bed medium and could therefore be used to indicate the bacterial condition of the latter without continual disturbance of the bed.

During the first two months the beds all received the same treatment and the analyses showed that the three beds were similar in every respect. On the 67th day from the start B was toluened for the first time. The

effect of this on the effluent was first a drop, then a large increase in the number of bacteria growing on gelatine, and a decrease of the percentage purification. The bed, however, recovered comparatively quickly and was practically normal again at the end of a week. The treatment was repeated at intervals varying from 7 days to 3 weeks, always with the same results, the effluent from B never reaching the same degree of purification as that from A. After eight months, B produced for the first time an effluent better than A. This occurred 56 days after previous toluene treatment and from that time forward the superiority of B's effluent was maintained in spite of repeated treatment with toluene.

At the end of the 13th month the protozoa in B were reduced to 760 per cc. of the bed medium, while A contained 2240 per cc., but a series of bacterial counts carried out during the 12th and 13th months indicated that the number of bacteria in the effluent from B was only slightly higher than the number in the effluent from A. It was therefore difficult to attribute the superiority of B over A to the increase of bacteria owing to the removal of the animal population. When, however, the capacities of the two beds were compared, a considerable difference was observed between A and B. While the original capacity of A had only been reduced 7.06 per cent by the 13th month, that of B had been reduced 15.7 per cent, and the difference of the surface deposit on the clinkers was evident to the naked eye, that of B being moister and more spongy, while that of A was more granular. But this very reduction in capacity and change in the character of the surface deposit, which may be ascribed to the removal of the animal forms, would improve the purity of the effluent by increasing the surface of the bed, and would consequently account for the superior results given by B over A.

During the 13th month, C as well as B was toluened, and confirmed the results obtained with B at the start. In a last set of experiments, when the tank effluent was replaced by a dilute peptone solution (1 part of albuminoid ammonia per 100 000) in order to eliminate the effect of the continual addition of extraneous organisms and colloid matter, the toluened bed C showed greater purification that the untreated bed A, while, at the same time, the capacity of A increased and that of C did not, owing to its animal population attacking and removing the solid deposit.

Thus the animal population of a contact bed helps to keep the latter open and from this point of view is desirable, but outside this effect it seems to have little influence on the actual purification processes taking place. The increased number of bacteria capable of growing on gelatine which were present in the beds after toluene treatment was not correlated with a higher degree of purification, and the writer suggests that counts on nutrient gelatine do not necessarily indicate the number of bacteria involved in the purifying processes, for growth on gelatine is chiefly a putrefactive process, while purification is chiefly an oxidation process. In this connection, the work of MÜLLER is referred to, where it is shown that protozoa in water reduce the number of bacteria capable of growing on gelatine, but do not affect those growing on albumose agar; from this the conclusion is drawn that protozoa prey only on bacteria foreign to water (*B. coli*,

B. typhosus, etc.) and leave the normal population untouched. Applying this idea to the case of sewage, very suggestive results were obtained by plating effluents simultaneously on gelatine and albumose agar, when the order of the counts obtained from beds A and B was reversed. The writer only puts forward this explanation tentatively, as the experimental evidence on which it is based is still very slight; but according to it, the removal of protozoa would not only reduce the capacity of a bed but would also tend to decrease its power of purification by allowing the increase of the putrefactive organisms and a consequent decrease of the normal population, the better results obtained with B than with A after eight months being solely attributed to the increased surface of bed B. But in any case, the continual addition of sewage rich in all classes of bacteria must tend to keep the population fairly stable and tend to nullify any selective effect which the protozoa may possess.

MANURES AND MANURING

500 – **The Manurial Value of Phonolite** (1). — NEUMANN, R. in *Fühling's Landwirtschaftliche Zeitung*, Year 63, Part 8, pp. 278-291. Stuttgart, 1914.

It has already been demonstrated by a number of pot and field experiments that phonolite possesses a certain manurial value, which, however, cannot be compared with that of the common potash manures, because of its insolubility, and the use of ground phonolite has therefore been deemed inadvisable owing to its high price and limited efficiency.

In 1912 a new phonolite appeared on the market, the "Vulkan-phonolith", which was claimed to be more valuable than those previously known and to possess the property of fixing nitrogen. In spite of repeated warnings against it from competent quarters it succeeded in gaining a footing in several countries. In order to give greater weight to its warnings, the Experimental Station of Hohenheim started a series of pot and field experiments with the new phonolite in the autumn of 1912. The investigations were planned: 1) to compare the values of phonolite and kainit as potash manures by the addition of kainit on the one hand and of phonolite on the other to a fundamental manuring of basic slag and nitrate of soda; and 2) to ascertain the existence of the alleged nitrogen-fixing property by comparing an unmanured soil with one treated with phonolite. The plants used were winter and spring barley and mangolds. The fertilizers used had the following composition:

Vulkan-phonolith:
7.3 per cent. total potash (soluble in hydrofluoric acid).
5.0 » » potash soluble in hot concentrated hydrochloric acid.
0.4 » » potash soluble in hot water.
Kainit: 15.1 per cent. K_2O.
Basic slag: 16.3 per cent. citrate soluble P_2O_5.
Nitrate of soda: 15.3 per cent. N.

(1) See also: No. 233, *B.* March 1913; No. 349, *B.* April 1913; *B.* Oct. 1913, p. 1483: original article by Prof. LEMMERMANN: On the Possibility of Replacing Stassfurt Potash Salts by Finely Ground Phonolite, Leucite, etc.

The writer summarizes the results of his experiments and observations as follows:

1. The affirmation that "Vukaln-phonolith" possesses the property of nitrogen fixation has not been confirmed by either the pot or the field experiments.

2. In the barley field the only effect of phonolite was to increase the yield of straw; this increase, however, was greater when the same amount of potash was given under the form of kainit.

3. In these same experiments kainit also gave a large increase in the yield of grain.

4. With mangolds, phonolite produced a heavier crop of roots, but the increase was only apparent, for on examining the amount of dry matter in the crop it was found that there was no real increase. With an equal amount of potash given as potash salts the yield of dry matter was considerably higher.

5. The experiments have failed to prove any superiority of "Vulkan-phonolith" over the other phonolite.

501 – **New Investigations with Magnesium.** — MIÈGE, E. and COMPAIN, E. in *La Vie agricole et rurale*, Year III, No. 19, pp. 532-533. Paris, April 11, 1914.

Applications of dolomite (having a lime - magnesia ratio of 1.5) were made as follows on plots 0.6 acre in area:

Plot 1. — Raw dolomite at the rate of 6 ½ cwt. per acre.
Plot 2. — Roasted dolomite » » »
Plot 3. — Lime » » »
Plot 4. — Control.

The soil was a clay loam having the following percentage composition:

	Soil	Subsoil
Nitrogen	0.18	0.16
Phosphoric acid	0.21	0.20
Potash	0.13	0.09
Lime	0.86	0.65
Magnesia	—	0.35
Iron	4.61	4.89
Organic matter	1.71	1.49
Coarse sand	31.01	32.26
Fine sand	59.58	56.17
Clay	8.53	10.67
Humus	1.28	1.19
Reaction	alkaline	neutral

The manure was hand sown and harrowed in. The land was then ploughed a second time and tankard mangels were sown on June 25. The latter were harvested on October 29 and yielded the following weights per acre.

Plot 1. — Raw dolomite	25	tons
Plot 2. — Roasted »	26.5	»
Plot 3. — Lime	28.5	»
Plot 4. — Control	27.5	»

These results show that the dolomite had a distinctly depressing effect on the yield.

AGRICULTURAL. BOTANY. CHEMISTRY AND PHYSIOLOGY OF PLANTS

502 – **Report of the Imperial Economic Botanist for India, 1913.** (1) — HOWARD, A. in *Report of the Agricultural Research Institute and College, Pusa*, 1912-13, pp. 26-52. Calcutta, 1914.

Wheat Experiments.

The improvement in the quality of Indian wheats has now reached the practical stage and extensive seed farms have been established for the distribution of high grade seed to the public. Mr. Humphries, of the Incorporated Society of British and Irish Millers, reports that these Pusa wheats produce good baking flours equal to those of the Manitoba spring wheats. At the same time both cultivators, landholders and the educated community in India prefer them to their own indigenous varieties.

Experiments in different localities in India have shown that these improved varieties retain their superior qualities whether grown on alluvial soils under irrigation or on the black cotton soils of the Deccan.

Further experiments are in progress with the object of producing strains of Pusa wheats with increased standing power, rust resistance and general hardiness.

Other Investigations.

Tobacco. — A type of tobacco has been found in Bihar suitable for cigarettes. It is known as Type 28 and seed is now being distributed to planters and Government farms in the Central and United Provinces. Partial sterilisation of the seed beds by surface fires has given excellent results in preventing loss of first sowings and seedlings.

The inheritance of characters has been studied and several promising strains have been isolated. It has been shown that the inheritance of such quantitative characters as size and shape of leaf follow Mendelian laws.

Gram (*Cicer arietinum*). — The selection experiments have been cont nued. The high yielding white strain again gave good results at Pusa and is being tried on the Government farms in the Central and United Provinces.

Fibres. — The study of the inheritance of characters in *Hibiscus Sabdariffa* is being continued. A promising strain of *H. cannabinus*, known as type 3, has been grown for fibre with satisfactory results, and seed will be distributed during the season.

Indigo. — This work has been transferred from the Sirsiah Experiment Station to Pusa. Two problems await solution, *viz.* methods of

(1) See No. 357, *B.* April 1913. (*Ed.*).

avoiding loss of plant due to "wilt" during the late monsoon, and the production of a reliable seed supply in Bihar. The methods of pollination will also be studied with a view to applying modern methods of selection and breeding. Already valuable results have been obtained on the successful treatment of "wilt" and these will be published during 1914.

Development of the Fruit Industry in Baluchistan.

The raising of nursery stock and economy in the use of water for irrigation purposes has been effected. Clover as a green manure has given excellent results. A collect on of the most useful varieties of trees from the south of France is being made with a view to future developments.

Tomato cultivationis being attempted on a large scale, the plants being trained on the two-branch system combined with furrow irrigation.

Experiments on the packing and transport of fruits are also being carried out.

503 – **Research on Vegetable Physiology: III and IV.** (1) — MAZÉ, P. in *Annales de l'Institut Pasteur*, Vol. 27, No. 12, pp. 1093-1143; Vol. 28, No. 1, pp. 21-26. Paris, December 25, 1913, January 1914.

The functions of water. — In a perfectly balanced culture solution the volume of water transpired by the maize plant in producing a given quantity of dry matter is constant and independent of the concentration of the salts in solution. The addition of assimilable organic matter diminishes transpiration, and, in the case of sugar, the amount of dry matter in the plant is increased. In an unbalanced solution, an increase in the concentration of calcium nitrate from 0.5 to 1.0 per cent., or of calcium chloride from 0.5 to 2.0 per cent., lowers the rate of transpiration, whilst ammonium nitrate and potassium phosphate in excess, increase it.

The rate of transpiration by day is independent of that by night, but after a low temperature in the day-time the nocturnal rate of transpiration is more rapid. The rate of transpiration is also greater during the second half of the night than during the first. Other workers have observed a greater rate of transpiration in plants growing in poor soils, owing to the extension of the roots in the rapidly impoverished soil.

The mechanism of absorption. — In nature the soil solution is never physiologically balanced for the needs of the plants, and only those which ripen all their seeds at a definite period are able to complete the ripening process in an exhausted solution. Leguminous plants generally show all stages of development at the same time and require a nutritive solution of constant strength. Their roots are therefore sensitive indicators of the condition of a culture medium. In dilute solutions they develop luxuriantly, whilst in unbalanced solutions they grow to an abnormal length and the leaves do not develop at all.

The root is protected against the entrance of soluble substances by the presence of a mucilaginous sheath.

Secretory functions of roots. — The acid reaction of the excretions of roots would be favourable to diastatic action, but though soluble starch

(1) See No. 3108, *B.* Nov.-Dec. 1911; No. 19, *B.* Jan. 1914.

in a culture solution may be absorbed by roots, there is no evidence of the formation of invert sugar in the medium. Saccharose in culture medium is partially converted into invert sugar, but sucrase cannot be detected. The leaves and stem contain 78.9 per cent. of invert sugar. It therefore appears that saccharose is absorbed as such, inverted in the leaves and returned to the roots to be excreted as invert sugar.

Conditions of fructification in aseptic solutions. — In 1911, fructification was only obtained in cultures containing sodium nitrate. Under other conditions, the plants appeared to be disturbed during the development of the reproductive organs ; several female ears were produced, the majority of which aborted. During the migration of reserves to the fertilised ovaries the composition of the nutritive solution requires to be changed to meet the requirements of the plant.

The influence of mineral salts on the growth of maize.

The solutions were made with ordinary tap-water, since fructification does not take place in distilled water owing to the absence of traces of certain substances. The influence of calcium carbonate, sulphur, iron, manganese and zinc was studied.

Calcium carbonate. — When calcium carbonate is replaced by calcium chloride in culture solutions containing ammonium salts, the roots show abnormal development and the medium develops an acid reaction. If the nitrogen is supplied as sodium or ammonium nitrate, the medium becomes alkaline and abnormal root development takes place. It is therefore necessary that calcium should be present in the form of carbonate. The quantities of iron, manganese, and zinc present in culture solution would be fatal if supplied as pure solutions in distilled water. They are precipitated by the calcium salts in the culture solution and are only rendered soluble gradually as the culture solution becomes acid or alkaline.

Influence of sulphur and iron. — In the absence of sulphur and iron, plants gradually develop chlorosis and become sterile. A drop of solution containing iron or sulphur placed on the discoloured leaves restores the green colour and the functions of the chlorophyll.

Influence of manganese. — The difficulties of depriving a plant of manganese owing to its presence in glass and in the seeds, diminishes the chlorotic effect of its absence from the solution. Solutions of manganese do not restore the discoloration due to manganese chlorosis, but the sap of normal maize plants appears to contain some specific substance which restores the chlorophyll function.

Influence of zinc. — In the absence of zinc, the roots become covered with a yellowish deposit of sulphur. The leaves gradually darken, take on a metallic appearance and become incrusted with mineral matter causing the death of the plant.

Pure solutions of nitrate, phosphate, sulphate and chloride of soda, potash and lime are only favourable to growth in concentrations between

0.5 and 0.1 per cent. Ammonium salts of the same acid radicles are not tolerated at concentrations exceeding 0.5 per cent.

Calcium nitrate appears to favour the development of long roots, thus making a greater depth of soil available to the plant.

504 – **The Resistance of Leguminous Seeds to High Temperatures.** (Publication of the Faculty of Natural Science of the Royal Hungarian Academy of Agriculture at Magyaróvár). — NEUBERGER, F. in *Kisérletügyi Közlemények*, Vol. 17, No. 1, pp. 121-168 (pp. 169-170, German abstract). Budapest, January-February 1914.

The experiments were made with seeds of *Vicia Faba, Vicia sativa, Phaseolus vulgaris, Pisum sativum, Lens esculenta, Medicago sativa* and *Trifolium repens*. The seeds were submitted to the action of dry heat at a temperature of 50° to 130° C. for from ½ hour to 6 hours, and to the action of warm water at a temperature of 45° to 100° C. during ½ hour to 2 hours. They were then germinated in a Weinzierl apparatus. The results are summarised in Tables I and II.

The effect of heat on germination is proportional to its intensity and duration. Up to a temperature of 80° C. dry heat acting for a certain length of time is not injurious to germination. Above 80° C. the resistance of the individual seeds of different varieties varies considerably. For any given species the resistance to heat is inversely proportional to the water content of the seeds, and may be increased to some extent by careful drying. The highest temperature to which leguminous seeds have been subjected without destroying their germinating power is 130° C. Immersion in water at a temperature higher than the maximum temperature of germination has no injurious effect if the immersion takes place before the seeds begin to swell. The relative resistance of different species may be considered a special characteristic of each species.

According to the writer the injurious action of heat is due to the destruction of enzymes which control the germinating power of the seed. Further researches are being made on this subject.

TABLE I.

Influence of dry heat on the germinating power of leguminous seeds.

	Initial germination capacity %	70°	80°	90°			100°			110°				120°				125°			130° C.		Total of percentage germinations. (70°-130° C.)
		Duration of treatment in hours :																					
		6	6	2	6	6	2	6	6	½	1	2	6	½	1	2	6	½	1	2	½	1	
		Pecentage germination																					
Broad beans (*Vicia Faba*)	100	98	99	99	98	27	97	81	18	90	14	10	0	68	0	0	0	0	0	0	0	0	799
» » (*Vicia Faba*) (attacked by grubs)	97	96	95	100	94	36	95	90	30	95	75	31	3	71	0	0	0	0	0	0	0	0	911
Haricot beans (*Phaseolus vulgaris*)	98	96	96	88	68	9	75	41	0	36	0	0	0	1	0	0	0	0	0	0	0	0	510
Peas (*Pisum sativum*)	96	95	94	77	74	39	68	20	0	69	52	18	0	2	0	0	0	0	0	0	0	0	604
Lentils (*Lens esculenta*)	98	99	90	93	86	59	92	76	49	97	27	17	12	80	4	0	0	0	0	0	0	0	885
Vetches (*Vicia sativa*)	100	99	99	97	99	84	94	95	44	100	96	98	80	100	91	40	10	90	39	0	17	0	1 472
Lucerne (*Medicago sativa*) . . .	90	95	85	86	79	75	82	85	35	90	86	86	91	91	79	65	43	67	43	3	2	0	1 368
White clover (*Trifolium repens*) .	01	92	82	85	87	64	85	86	40	91	88	80	67	88	80	72	67	91	90	25	40	0	1 500

TABLE II.

Influence of warm water on the germinating power of leguminous seeds.

	Initial germination capacity %	45°		50°		55°		60°		65°			70°			75°			80° c.		Total of percentage germinations
		Duration of treatment in hours:																			
		1	2	1	2	1	2	1	2	⅓	1	2	½	1	2	½	1	2	½	1	
		Percentage germination																			
Broad beans (*Vicia Faba*)	100	99	98	97	72	60	0	39	0	66	45	0	33	17	0	13	4	0	3	0	646
Haricot beans (*Phaseolus vulgaris*)	98	100	89	26	0	4	0	1	0	12	0	0	0	0	0	0	0	0	0	0	232
Peas (*Pisum sativum*)	96	94	78	59	21	24	15	16	8	12	8	0	8	5	0	9	4	0	2	0	363
Lentils (*Lens esculenta*)	98	97	92	19	3	9	7	5	0	7	3	0	0	0	0	0	0	0	0	0	242
Vetches (*Vicia sativa*)	100	100	98	89	80	62	41	53	33	69	53	28	73	42	15	53	18	4	4	0	915
Lucerne (*Medicago sativa*)	90	88	93	76	31	25	8	14	7	9	4	0	6	8	0	4	3	0	1	0	377
White clover (*Trifolium repens*)	91	90	85	89	47	9	5	10	4	13	5	0	15	7	0	12	4	0	3	0	398

505 – **The Survival of Plant Tissues after Frost.** — RUSSEL, W. in *Comptes-Rendus de l'Académie des Sciences*, Vol. 158, No. 7, pp. 508-510. Paris, February 16, 1914.

Plant cells contract under the influence of cold, and the water passing through the cell-walls freezes in the intercellular spaces (1). The thin-walled parenchyma is dislodged by the accumulation of ice, and the portions deformed and often crushed soon show disorganisation of the protoplasm through loss of water. This disorganisation rarely affects the whole of the parenchymatous tissue; the vascular tissue, the endodermis and the pericycle generally persist, whilst the lignified and corky parenchyma often remain unchanged.

It is generally believed that plants which are not able to resist severe cold, show no living tissues after a thaw. The writer, however, using Ruzicka's reagent (2), has shown the presence of living cells amongst the disorganised tissues, and in the slightly injured tissues numerous cells took up the red stain characteristic of living protoplasm.

The damaged tissues may continue to live a considerable time after a thaw, and this is borne out by the fact that plants do not perish immediately, however wilted and disorganised their organs may appear, but may continue to live several days or even weeks (3).

Plants with living cells in the vascular tissues and adjacent parenchyma only succumb very slowly ; the xylem and phloem parenchyma is the last tissue to be destroyed. Thus, a specimen of *Sonchus oleraceus* destroyed by frost at the end of December, still contained living cells on February 9th in the thick lignified cork ring at the base of the hollow stem, which had been completely decorticated.

Thus, the death of a plant through frost does not take place suddenly, but rather cell by cell, and is retarded proportionately to the amount of undamaged tissue.

506 – **The Effects of the Winter of 1913-1914 on Certain Plants.** – MOTTET, S. in *Revue Horticole*, Year 86, No. 9, pp. 202-204. Paris, May 1, 1914.

During the winter 1913-14, the soil in the neighbourhood of Paris was frozen to a depth of from 12 to 14 in. Of the newly introduced plants at the DE VILMORIN experimental ground at Verriéres, those from China completely resisted the cold.

A list of the plants damaged by the frost is given below, grouped according to the extent of the damage.

(1) PRILLIEUX, Effect of frost on plants (*Bull. Soc. Bot.*, 1869) — MUELLER-THURGAU, *Landwirtsch. Jahrb.*, 1883 and 1886. — MOLISCH, Ueber das Erfrieren der Pflanzen. Jéna 1897. — MOLLIARD and MATRUCHOT, Aaction du gel sur les cellules (*Revue gén. de Bot.*, 1902). P. SORAUER, Wärmemangel. (*Handbuch der Pflanzenkrankheiten*. I. I. 1909).

(2) V. RUZICKA, Ueber tinktorielle Differenzen zwischen lebendem und abgestorbenem Protoplasma (*Arch. ges Physiol.*, T. CVII, pp. 437-534).

(3) Observations on *Papaver Rhoeas, Sisymbrium officinale, Cheiranthus Cheiri, Trifolium pratense, Achillea Millefolium, Ballota foetida, Lamium album, Euphorbia silvatica, Mercurialis annua, Urtica urens*, etc.

A. — Woody Plants.

1. Plants completely frozen.

Arctostaphylos arguta.
Duddleia macrostachya yunnamensis.
Cistus purpureus.
Cistus hirsutus.
Eugenia apiculata.
Berberidopsis corallina.
Fagus Cunninghami.
Olearia macrodonta.
Stranvæsia glaucescens.
Pittosporum undulatum.
Pinus longifolia
» *Montezumæ* var. *Lindleyi.*
» *oocarpa.*
» *microphylla.*
» *Lumholtzii.*
» *pseudo-Strobus* var. *tenuifolia,*

2. Plants badly damaged.

Arundinaria Falconeri.
Arundinaria humilis var. *gracilis*
Abies religiosa.
Bambusa Nagashima.
Carpenteria californica.
Lithospermum prostratum.
Mandevillea suaveolens.
Helianthemum roseum.
Teucrium fruticans.
Pinus Montezumoe.
» *patula.*
» *Teocote.*
» sp. 6956 M. V. China.

3. Plants having their leaves or only their extremities frozen.

Actinidia Henryi.
Azalea candida.
Arundinaria auricona.
» *Simonii* Chinese var.
Azara microphylla.
Clematis Armandi.
Escallonia pulverulenta.
Ercilla spicata.
Garrya elliptica.
Eucalyptus coccifera (1).
Elœagnis Simonii.
Keteleeiria Davidiana
Myrsine africana
Nandina domestica.
Quercus Suber.
» spec. no. 26, Yunnan.
» » no. 11, Tonkin.
Xylosma sp. 7220 M. V. China.
New genus, no. 4395, Wilson.

B. — Herbaceous Plants.

1. Plants completely frozen.

Anthemis montana.
Arundo conspicua.
Francoa ramosa candida.
Erodium pelargonifolium.
Rehmannia angulata and hybrids.
Salvia dichroa.

2. Plants more or less damaged.

Aconitum Vilmorinianum.
Lupinus arboreus.
Hypericum polyphyllum.
Tritoma rufa.
Sisyrinchium striatum.

(1) Old leaves damaged. Young leaves resistant.

3. Plants of doubtful hardiness which have shown complete resistance.

Asimina triloba.
Abutilon vitifolium.
Abies bracteata.
Aristotelia Macqui.
Camellia japonica.
Clematis cirrhosa.
Clematis balearica.
Clerodendron fœtidum.
Castanopsis chrysophylla.
Baccharis patagonica.
Fuchsia Riccartoni (covered at the base).
Carrya Thureti.
Oreodaphne californica
Olearia nummulariœfolia
Pinus koraiensis
" *Ayacahuite.*
Prumnopitys elegans.
Tsuga Brunoniana.
Rhododendron campylocarpum.
Piptanthus nepalensis.
Rosa lævigata.
Rhododendron Griffithianum hybrids.
Eriobotrya japonica (covered at the base).
Mimosa dealbata (covered at the base).
Zizyphus vulgaris.
Punica Granatum var. *Legrellei.*

507 – **The Indicator Significance of Vegetation in the Tooele Valley, Utah.** — Kearney, T. H., Briggs, L. J., Shantz, H. L., Mc Lane, J. W. and Piemeisel, R. L. in *Journal of Agricultural Research*, Vol. I, No. 5, pp. 365-417, + 7 plates. Washington, D. C., February 1914.

This investigation of the correlation existing between the distribution of the vegetation and the physical and chemical properties of the soil was carried out in the Great Basin region between the Rocky Mountains and the Sierra Nevada and Cascade ranges. The problems to be solved were: 1) what types of vegetation indicate conditions of soil moisture favourable or unfavourable to dry farming, and, 2) what types indicate the presence or absence of alkali salts in quantities likely to injure cultivated crops. For the purpose of this investigation it was necessary to find a locality where both dry farming and irrigation farming are practised, where much of the land is still covered with the original native growth, and where some of the soils contain an excess of alkali salts. The Tooele Valley in Central Utah was selected as representing these conditions. The natural vegetation of this valley consists of a few easily recognisable and sharply delimited plant communities, the distribution of which is largely determined by the moisture relations and the salt-content of the soil.

These correlations are summarised in the table opposite.

The sage brush (*Artemisia tridentata*) occurs nearest the mountains where the soil is of a light, permeable texture, rather low in moisture holding capacity, and free from an excess of alkali salts, and where the moisture available for growth is usually exhausted early in summer. A good growth of sage brush indicates suitability for both dry and irrigation farming, but where the growth is thin and poor irrigation is necessary.

The Kochia (*Kochia vestita*) association occurs just below the sage brush belt. The soil is of a finer texture, less permeable and with a higher moisture holding capacity, and the subsoil has a higher salt content. Dry farming is precarious owing to the shallow depth of soil free from alkali and its impervious nature hinders the washing out of the salts by irrigation.

Type of vegetation	Moisture and salinity conditions.					Is land capable of crop production ?	
	Source of moisture	Moisture content above or below wilting coefficient (1) average of 4 feet	Salt content average to depth of 4 feet	Surface soil	Soil below one foot	Without irrigation	With irrigation
Sagebrush (*Artemisia tridentata*)	Direct precipitation	— 0.8	0.4	Non-saline, usually dry in summer	Non-saline, usually dry in late summer	Yes	Yes
Sandhill mixed (*Artemisia tridentata, Juniperus utahensis*, etc.	do			do	Non-saline, usually moist in summer		
Shadscale (*Atriplex confertifolia*)	do	— 5.3	0.52	do	Saline, usually dry in late summer	Precariously, conditions rather more favaurable than on Kochia land	Yes: after alkali is removed
Kochia (*Kochia vestita*)	do	— 3.0	0.70	do	Saline usually dry, in late summer	Precariously in years of rainfall above the normal	Yes, if alkali can be removed
Greasewood-shadscale (*Sarcobatus* and *Atriplex*)	Direct precipitation and high water table	+ 3.0	0.81	Saline or non-saline, usually dry in summer	Saline, moist	No	Yes, after alkali is removed
Grass flat (Salt grass, *Distichlis spicata*)	Direct precipitation, high water table, springs and irrigation	+ 12.1	0.86	Moderately saline, moist	Moderately saline, moist	Probably not	Possibly, with drainage
Salt flat (*Allenrolfea occidentalis*)	Direct precipitation and high water table	+ 4.2	1.11	Saline, moist	Saline, moist	No	No

(1) Wilting coefifcient = the quantity of water as percentage of dry weight remaining in the volume of soil occupied by the active roots of a plant which is begining to wilt. — All data are given as percentages of the dry weight of the soil.

The shadscale (*Atriplex confertifolia*) association occurs below the Kochia belt. The soil is similar, but frequently contains much gravel and is drier during the summer months. Owing to its greater permeability, irrigation farming would be possible on this land.

The greasewood-shadscale (*Sarcobatus vermiculatus* and *Atriplex confertifolia*) association occurs between the pure shadscale vegetation and the salt flats and also on the ridges and knolls intersecting the latter. The soil generally contains sufficient available moisture below the first foot during the summer and considerable quantities of alkaline salts. Land of this type is not suitable for dry farming, but can be made to produce good crops under irrigation, especially when drainage is provided.

The presence of the grass-flat (*Sporobolus, Distichlis, Chrysothamnus*) vegetation indicates a soil with high moisture capacity, moist to the surface during a great part of the year and more or less saline. Such land produces a coarse natural pasturage, but is not suitable for crop-production until drained.

The salt-flat (*Allenrolfea, Salicornia*) vegetation occupies land which is extremely saline and wet to the surface during a great part of the year. This type of land is not adapted to crop production.

508 – **The Error in Water Culture Experiments due to the Presence of Traces of Zinc in Glass.** — JAVILLIER, M. in *Comptes Rendus hebdomadaires des séances de l'Académie des Sciences*, Vol. 158, No. 2, pp. 140-143. Paris, January 12, 1914.

Culture experiments with *Aspergillus niger* in Raulin's solution with and without zinc show different results according to the nature of the vessel employed. Thus :

	Dry weight in grammes.		
	Bohemian Glass (Kavalliier)	Jena Glass (Schott and Gen)	Quartz glass
Raulin solution without zinc	0.352	1.861	0.291
» » with zinc	1.780	1.736	1.624

In a solution of hydrochloric acid equivalent in acidity to that of Raulin's solution the writer found 0.05 mgm. of zinc per 125 cc.

509 – **Contribution to the Study of the Formation of Hydrocyanic Acid in Plants.** — JORISSEN, A. in *Bulletin de la Classe des Sciences de l'Académie Royale de Belgique*, No. 3, pp. 130-137. Brussels, 1914.

As the result of a number of laboratory experiments, the writer concludes that hydrocyanic acid may be produced in dilute solutions of potassium nitrite and citric acid when the latter is subjected to oxidation by the action of small quantities of iron salts under the influence of light rays. One stage in the transformation would be acetone-dicarboxylic acid ($COOH-CH_2-CO-CH_2-COOH$) which is produced by the action of heat on a mixture of concentrated sulphuric acid and citric acid, or by the action of potassium permanganate on citric acid. Acetone-dicarboxylic acid yields hydrocyanic acid in the presence of dilute solutions of potassium nitrite.

510. - **Note on the Displacement Curves** (1) **of Organic Bases and their Application to the Determination of the Strength of Alkaloids.** — GOUBAU, R. in *Bulletin de la Classe des Sciences de l'Académie Royale de Belgique*, No. 1, pp. 63-90. Brussels, 1914.

The writer has applied the method of DUTOIT to the determination of certain alkaloids. A known quantity of hydrochloric acid is added to a given quantity of the alkaloid. The solution of the salt thus obtained is diluted with water or alcohol. The conductivity is then determined at constant temperature. A solution of normal or decinormal caustic soda is added, 0.1 cc. at a time, and the displacement of the alkaloid by each addition of caustic soda is determined by the change in conductivity of the solution. A displacement curve is obtained by plotting the conductivity against the quantity of caustic soda.

The first part of the curve is a straight line corresponding to the neutralisation of the free acid ; the second part, corresponding to the hydrolysis of the alkaloid, consists of one or more straight lines according as the alkaloid is mono or polybasic ; the third part corresponds to the addition of excess of the soda solution. The angles of the curve are more acute in proportion as the solution is less hydrolysed.

The method has been successfully applied to the following alkaloids : *Cocaïne* in solution in alcohol, even in the presence of small quantities of sugar, colouring matter, etc. *Homatropine* in a solution of equal quantities of water and alcohol, and hydrolysed by normal caustic soda solution. *Atropine* in a solution of equal quantities of water and alcohol. The percentage of atropine in pharmaceutical preparations of belladonna can be determined with accuracy by extracting the acid solution with ether or chloroform after removing foreign matter such as resin, chlorophyll, etc. The percentage of *aconitine* in laboratory preparations of aconite can be determined in the same way. *Pilocarpine* and *codeine* are determined in aqueous solutions ; *strychnine* in a solution of 5 parts of alcohol to 4 parts of water. These proportions are less reliable for *coniine* (hemlock) and *nicotine* owing to hydrolysis of the salts. The curve for *morphine* (which may act either as a base or an acid) consists of four sections corresponding to the neutralisation of free acid, the displacement of morphine, the formation of sodium morphinate and the addition of free alkali.

511 – **Methods and Results of the Selection of Flax in Russia.** — ALTHANSEN, L. (Laboratory of Agricultural Chemistry, Central Administration of Agricultural Organisation at St. Petersburg) in *Russisches Journal für experimentelle Landwirtschaft*, Vol. XV, Part 1, pp. 12-47 + 11 plates (German Summary, pp. 48-53). St. Petersburg, 1914.

PLANT BREEDING AN AGRICULTURAL SEEDS

An account is given of the principles and methods applied to the selection of flax at the Laboratory of Agricultural Chemistry, St. Petersburg. The native varieties of flax consist of mixtures of types affording excellent

(1) See *B.* Dec 1912, pp. 2562-2569, original article on « Analysis of wines by a Physico-chemical Volumetric Method » by P. DUBOUX and M. DUTOIT. (*E. d.*).

material for the selection and separation of strains. Although pure line varieties chosen for some special peculiarity offer distinct advantages, the power of resistance to unfavourable conditions of growth is greater in a variety consisting of a mixture of types. Thus it is possible that certain mixtures of pure lines will give the best results. The isolation of types is comparatively easy, even for the less evident characters, and hybridisation experiments are also being carried out.

In 1913, 601 F_1 generations and 195 F_2 generations had been obtained. The combination and the separation of types is not difficult to observe and does not require much time. Selection is conducted in the laboratory on the results of field observations and determinations of the quality of the fibre.

Great importance is attached to field trials on a large scale. The numerous measurements and the counting necessary are effected with as much economy as possible. Young people who need only read, write and count are employed for the mechanical work, each determination being made by two persons independently. In reducing the necessary measurements to express the character of the type, much calculation and time is saved by using the "individual" mean in place of the arithmetic mean. This method works as follows: the selected plants are arranged in the order of their heights; the centre plant of the series and five neighbours on each side of it are then measured. The arithmetic mean of these plants is considered as the "individual" mean of the series and is sufficiently accurate for practical purposes. The economy of time thus effected enables determinations to be made of other characters, such as length of unbranched stem, diameter of stem and the number of seeds.

The selected types are grown in rows between rows of native varieties, so that the result of each row can be compared with the results of two rows of a control variety. The accuracy of the trials is increased in the second generation by sowing four rows of each strain from the seed produced in the first generation. The risk of cross-fertilisation in this method is inconsiderable, since self-fertilisation is the rule in flax.

The sowing of the seeds is facilitated by arranging them in the laboratory on strips of perforated cardboard. The strips are the length of the rows and the lower side of the perforations is closed by a sheet of thin paper. The seeds therefore rest in small cavities thus formed, about ½ in. apart, and, at planting time, the strips are laid on the soil and the seeds buried by means of a glass rod. This method ensures accuracy and economises time and labour. It is also used for testing the strains on a larger scale, by using larger sheets of cardboard and dispensing with the alternate rows of native varieties. In this case each sheet holds 120 seeds and two such sheets containing different varieties constitute a trial plot. The plots are duplicated from 4 to 8 times.

When sufficient seed has been obtained, the strains are then grown as field cultures and determinations made of the quality of their fibre. This stage has now been reached by varieties which have been under selection since 1909.

512 – **On the Appearance of Sterile "Dwarfs" in *Humulus Lupulus* L.** — SALMON, E. S. in *Journal of Genetics*, Vol. 3, No. 3, pp. 195-200 + 3 plates. Cambridge, February 1914.

In experiments on hybridising various male and female hops, numerous sterile dwarfs appeared in the F_1 generations. These dwarfs are characterised by very feeble growth the first year, by the subsequent development of numerous shoots prostrate on the surface of the ground or forming an erect bush-like growth about one foot high, and by the complete absence of flowers even after 7 years' growth. The proportion of sterile dwarfs to normal plants in the F_1 generations varies in different crosses and is greatest in those in which the male hop is a form from Oregon, U. S. A.

513 – **A Preliminary Note on the Genetics of *Fragaria*.** — RICHARDSON, C. W. in *The Journal of Genetics*, Vol. 3, No. 3, pp. 171-177 + 4 figs + 1 plate. Cambridge, February 1914.

Crosses between *Fragaria vesca semperflorens*, a runner-producing plant, and *F. de Gaillon*, a runnerless species, always produce runner-producing plants in F_1 and runner and runnerless plants in F_2, the runner being a marked dominant.

A cross between *F. vesca* having normal trifoliate leaves and *F. monophylla* produced normal plants in F_1, and showed segregation in F_2, producing 177 normal plants and 73 with single leaves.

Eight garden varieties were selfed and some 1000 plants obtained. Of these none showed any resemblance to *F. vesca* or to any Alpine species, but many showed distinct traces of *F. chinensis*, more of *F. virginiana* and not a few of *F. chinensis*. The leaf-character of "Hantbois" occasionally appears in those of French origin.

"St. Antoine de Padoue", a perpetual variety, was selfed and produced an F_1 generation consisting of 93 perpetuals, 35 non-perpetuals and 2 doubtful ones. Examination of these same plants the following year showed them to consist of 108 perpetuals and 22 non-perpetuals. "Laxton's Perpetual" gave an F_1 generation of 69 perpetuals, 11 non-perpetuals and 2 doubtful.

A cross between "Bedford Champion" (non-perpetual) and Laxton's Perpetual gave rise to 24 perpetuals and 53 non-perpetuals, whereas the simplest expectation would have been equality.

One of these F_1 non-perpetuals gave rise to an F_2 generation consisting of 8 non-perpetuals and 6 perpetuals, and an F_1 perpetual produced 14 non-perpetuals and 5 perpetuals in F_2.

The evidence points to the existence of several factors determing the perpetual character.

Experiments on the inheritance of sex were made with female *F. virginiana* and male *F. chiloensis lucida*.

Thus, *F. virginiana* ♀ × *F. chilœnsis* ♂ (1)

16 ♀ 6 ☿ 12 ♂

and *F. virginiana* ♀ × *F. chilœnsis lucida* ♂

49 ♀ 16 ☿ 27 ♂

and *F. virginiana* ♀ × *F. grandiflora* ☿

20 ♀ 14 ☿ 0 ♂

A cross between *chiloensis* hermaphrodite and *grandiflora* hermaphrodite produced a minority of hermaphrodites, a majority of males and no females, while the cross *virginiana* female and *grandiflora*, mentioned above, produced no males.

It appears that most characters of *Fragaria* are capable of segregation, but the occurrence of a certain amount of " linking " may present difficulties requiring many years to solve.

514 – **The Farmers' Seed-Growers' Cooperative Association in Wisconsin.** — MATENÂERS, F. F. in *Deutsche Landwirtschaftliche Presse*, Year XXXXI, No. 29, pp. 363-364. Berlin, April 11, 1914.

The seed-growers' association known under the name of the " Wisconsin Experiment Association " was founded on a cooperative basis in the year 1901 by 187 members. In order to make sure that the members recognised the full importance of the objects in view, it was decided that at first only the farmers who had attended a State school of agriculture would be admitted as members.

The expenses of the Association were defrayed by the members only during the first two years. Since 1903 the State has granted a subsidy, which last year amounted to about $ 5000.

The activity of the Association has been considerable from the very beginning. After the secretary of the Association had decided upon the most suitable varieties of seed at the farm of the Experiment Association, every member received enough seed for two acres with which to carry out comparative trials. Altogether the experiments are conducted on a large scale ; thus for five years 1020 members experimented with barley and 1500 with maize. Already, from the beginning, the members in the various counties were invited to form centres for the supply of selected seeds in their vicinity. In this way 1500 centres for maize were established by the side of those for barley, oats and rye, and their action was such that the neighbouring farms soon adopted the new varieties and thus the desired uniformity in the varieties cultivated was attained, which contributed largely to the present reputation of the Association for its maize and other cereals.

The Association has also rendered valuable service in the control of plant diseases.

(1) The signs refer to the sex character of the species as well as to the sex of the parent. (*Ed.*).

Owing to the considerable growth of the Association, a certain decentralization has become necessary. It has been met by the foundation of local sections for the several counties, which bear the title of "County Orders of the Experiment Association." They are under the supervision of the central management and have a secretary who is appointed and paid by the State Association. When in a county more than fifty farmers grow seeds according to the instructions of the Association, such County Orders are founded. At present there are thirty-eight of them.

For the sale of the selected seed, special packages bearing the trademark of the Association are used. But previously, in the course of the year, the secretary of the County Order must have inspected the methods of selection and other treatment of the seed, and the central Association must have made a final examination of the seed. A special list is kept of the names of the producers of "inspected" seeds.

For the further promotion of the sale of seeds, the State Association has already erected some seed granaries furnished with the necessary appliances.

515 - **Report on the Work of the State Seed-testing Station in Denmark in the Year 1912-13.** — *Communication by the Director*, K. DORPH-PETERSEN.

This seed control station is the oldest in the world; it was founded in 1871 by E. MÖLLER-HOLST and taken over by the State in 1891. The importance which it has gained may be seen from the number of samples examined yearly and which, from 373, the average for the first five years of its existence, has risen to 14213 in the year now reported upon. Plant breeders and other farmers and their associations sent 6756 samples for examination in 1912-13.

The seeds are examined as to their quality and place of origin. For the latter the so-called characteristic seeds are looked for. Examinations as to origin are especially frequent for clover seeds and have largely contributed to prevent the importation of undesirable seeds. In the year of the Report, 176 determinations of the place of origin were made.

In the investigation into the purity of the goods, two average samples of at least 1000 seeds each are taken and the following determinations are made: *a*) content in seeds of the kind which gives its name to the parcel; *b*) the offal (earth, stones, broken seeds, etc); *c*) seeds of other cultivated plants; *d*) seeds of weeds. For the various contents the percentage by weight is given in the examination certificate. In the case of specially noxious weeds their number per kilogram is given also. The diaphanoscope is used for grass seeds that are difficult to examine. If the difference in the proportion of pure seeds in the two average samples is more than 2 per cent., a third determination as to purity is made and an average drawn from the three. A parcel which contains upwards of 15 per cent. of seeds of other cultivated plants is declared to be mixed goods. When the content of weeds and offal is considerably above the usual quantity, the sample is designated as "impure seeds". In 1912-13, 8957 determinations as to purity were made.

For the determination of germination capacity, six lots of one hundred "pure seeds" are placed to germinate in special apparatus. For most small seeds, Jacobsen's or the Copenhagen apparatus is used, as it ensures uniform moisture and allows the temperature to be regulated with precision.

For cereals, pulse and beets the germination capacity is determined after 10 to 12 days, for grasses after 15 to 20. The germination energy is determined after about one-third of the above time.

In 1912-13, 11431 germination tests were carried out, and in 6624 of these the purity and weight of the seeds were also determined. Further, 255 examinations for moisture content were made.

Of the samples examined, 1701 were so-called "second analyses" of seeds which had been delivered to farmers, associations or small traders. Thirteen seedsmen have made an agreement with the Station according to which they must send the latter the addresses of all their clients to whom they have sold guaranteed seeds, and this immediately after delivery . The Station then sends the purchasers instructions for taking samples and a small bag for the same. The examination is charged to the vendor. The results of the examinations are communicated to all the purchasers of the 13 seedsmen and they are also published in the yearly report of the Seed-testing Station. Most of the consignments made during the year have come up to the guarantee. Some of the seedsmen, however, have had to pay some compensation under the agreement with the Station.

The examination of seeds sold by traders who had no connexion with the Station showed that nearly one half of the samples did not correspond to the guarantee given with them. Out of the 17 ½ million lbs. of seeds sold in Denmark for grass leys, nearly 12 million lbs. are delivered by the controlled firms. A great proportion of root crop seeds were also tested by the Station.

The present state of seed testing has been brought about without any special legislation or other public measure.

The cost of testing is from 1*s* 1¼*d* to 7*s* 8½*d* per sample. Last year the State granted the Station £200. The rest of its expenses, the whole of which amount to £1925, is covered by the fees.

510 – **Impurities in Seeds in Victoria, Australia.** — *Communicated by the Department of Agriculture.*

Report on seed examined in January and February 1914.

Variety of seed	Country of origin	Weed seeds	
		Species	Percentage
1. Red clover (*Trifolium pratense perenne*) .	Germany	*Cuscuta* sp.	0.39
		Prunella vulgaris	0.05
		Daucus Carota	0.12
		Rumex crispus	1.17
2. White clover (*Trifolium repens*)	Russia	*Rumex Acetosella*	5.07
		Spergula arvensis	0.21
3. Cowgrass (*Trifolium pratense perenne*) . .	Austria	*Cuscuta* sp.	0.09
		Rumex crispus	0.79
		Carduus lanceolatus	0.02
		Daucus Carota	0.02
		Polygonum Convolvulus	0.02
4. Alsike (*Trifolium hybridum*).	Russia	*Rumex Acetosella*	3.61
5. Red clover (*Trifolium pratense perenne*). .	Germany	*Cuscuta* sp.	0.11
		Daucus Carota	0.02
		Rumex crispus	0.18
6. Lucerne (*Medicago sativa*)	Germany	*Cuscuta* sp.	0.02
		Raphanus sp.	0.22
7. Cowgrass (*Trifolium pratense perenne*) . .	Germany	*Cuscuta* sp.	0.12
8. Cowgrass (*Trifolium pratense perenne*) . .	Germany	*Cuscuta* sp.	0.14
		Rumex crispus	0.32
		Conium maculatum	0.02
9. White Mustard (*Sinapis alba*)	Germany	*Galium Aparine*	1.003
		Polygonum Persicaria	0.09
		Polygonum Convolvulus	0.45
		Conium maculatum	0.07
		Erysimum repandum	1.49
10. Gold of pleasure (*Camelina sativa*) . . .	Germany	—	—
11. Cress (*Lepidium ruderale*)	Germany	*Cuscuta* sp.	0.25
		Chenopodium album	1.15

In Nos. 2 and 4, $^3/_4$ oz. of seed was examined, in all the others 3 oz. Nos. 2 and 7 were cleaned under supervision.

Nos. 9 and 11 contained a small percentage of grit and loading (stalks, etc.).

Nos. 1, 3 and 8 contained also a little *Plantago lanceolata*; No. 4 *Plantago lanceolata*, *Medicago lupulina* and *Phleum pratense*; No. 5 *Plantago lanceolata* and *Cichorium Intybus*; No. 6 *Panicum* sp.

CEREAL AND PULSE CROPS

517 – **Investigations on Barley in Connection with the Separation of the Glumes through Rapid Drying.** — STIMMELMAYER, A. in *Landwirtschaftliche Zeitung*, Year 63, Part 6, pp. 214-216. Stuttgart, March 15, 1914.

The writer carried out at the Seed Selection Station at Weihenstephan, Bavaria, a series of experiments on a barley which showed no tendency to separate from its glumes, with the object of studying the influence of alternative moistening and rapid drying on the separation of the grain from the glumes.

Four groups of three ears with sound grains were steeped in separate vessels containing spring water at a temperature of 20° C. In the first experiment each lot of ears was steeped and dried for a different length of time at about 45° C., the ears being weighed after each operation in order to determine the average amount of water absorbed.

The result of the first experiment was generally negative ; only on a few grains could some cracking of the glumes be observed. The experiment was repeated three times with the same ears. At the third steeping the average weight of the ear after 24 hours' immersion had risen from its normal initial weight of 1.85 grams to 2.62 grams, that is it had absorbed 41.6 per cent. of water ; after eight hours' esiccation the average weight of the ear was 1.87 grams. The glumes of 28.2 per cent. of the grains were damaged by the repeated steeping and desiccation, which shows clearly that the alternative wetting and drying undergone by corn during the summer causes the glumes to crack without the intervention of any mechanical action. Repeating the steeping and desiccation a fourth time did not alter the condition of the grain.

To determine the effect of mechanical action, the above ears and others which had not been treated were vigorously rubbed by hand, and the damaged glumes and naked grains were counted. The untreated ears contained 28.4 per cent. of damaged grains, and of these 0.3 per cent. were quite naked ; the treated ears contained 62.4 per cent. of damaged grains, of which 3.7 per cent. were quite naked. This simple experiment shows clearly that the connection between the grain and the glume is loosened by alternate steeping and drying and becomes apparent when the grain is subjected to rough treatment, as is the case, for instance, in threshing. The loss of glumes in threshing, however, is far less serious to malting barley than the injury that may be caused by threshing in dry years when the grain is brittle and the damage is generally deeper and decreases the germinating power.

FORAGE CROPS. MEADOWS AND PASTURES

518 – **Analysis of Teosinte Seeds *(Reana luxurians = Euchlaena luxurians*, Asch.)** (1). — *Renseignements de l'Office Colonial*, Year 8, No. 3, pp. 130-141. Brussels, March 1914.

Chemical analysis of the kernels of this plant shows that it contains more food material than any cereal. The low food value of the seeds as a whole is due to the large percentage (56.37) of pericarp :

(1) See also No. 43, *B.* Jan. 1911 and No. 1567, *B.* Aug.-Sept.-Oct. 1911. (*Ed.*).

	Per cent of fresh kernel	Per cent of dry matter
Humidity (100° C.)	13.46	—
Mineral matter	1.36	1.57
Fat	4.16	4.80
Cellulose (Weende)	1.43	1.65
Total nitrogenous matter	21.25	24.57
Nitrogen-free extract (starch)	53.10	61.38
Pentosans	1.01	1.16
Undetermined	4.23	4.87
Total	100.00	100.00

The high proportions of nitrogenous matter, fat and starch give this kernel a food value of the highest order, as shown by the following figures :

	Food units in 100 parts of dry matter
Teosinte, seeds	135
Wheat flour	156
Flour from teosinte kernels	208.5
Lentil flour	230

519 – **The Cultivation of Sulla (*Hedysarum coronarium* L.) in Rice Fields.** — Sbrozzi, D. in *Il Coltivatore*, Year 60, No. 9, pp. 262-268. Casale Monferrato, March 30, 1914.

French honeysuckle or Sulla has long been known as a valuable forage crop for dry land cultivation in hot countries, but it is only within recent years that its suitability for cultivation in rice fields has been shown by experiments in Italy. The advantages of this forage crop are that it requires little cultivation, no special manuring and that it improves the soil by its deep rooting habit ; it leaves a considerable amount of humus behind and yields more forage than any other crop under similar conditions.

Seed is sown at the rate of about 2.68 lbs. per acre before harvesting the rice, about August 20th. After about a week, germination takes place and the rice is harvested. Small ditches are then cut to facilitate the drainage of the fields and the crop receives no further attention until the following spring, when it is thoroughly weeded. The crop is ready for cutting at the end of July. The residual phosphates of the manuring for the preceding rice crop are sufficient for the needs of this plant, and its deep rooting habit gives the soil an excellent preparation for the following wheat crop. This crop is therefore most suitable for making the transition from wet to dry land cultivation. The average yields obtained are 2 ½ cwt. per acre, valued at £3 12*s* per cwt.

The cost of cultivation and returns per acre are as follows:

	£ s d	£ s d
Expenses:		
Seed	2 6	
Sowing and opening ditches	8 0	
Weeding	3 3	
Cutting	14 3	
Transport	12 9	
Threshing	1 8 9	
Total		3 9 6
Returns:		
Seed	8 12 9	
Straw	19 3	
Total		9 12 0
Net profit per acre		£6 2 6

520 – **Cultivation Experiments with *Vicia striata* in Hungary, 1908-11.** — GYÁRFÁS, J. in *Kísérletügyi Közlemények*, Vol. XVII, Part 1, pp. 1-11. Budapest, January-February 1914.

Vicia striata, a plant indigenous to Hungary, has long been recommended as a forage crop for alkaline soils, and the Royal Hungarian Experimental Station at Magyaróvár has carried out a long series of experiments with both pot cultures and field trials in cooperation with several agriculturists.

The conclusions arrived at are as follows:

1) *Vicia striata* is less resistant to the action of saline salts than *V. sativa* and is consequently unsuitable for alkaline soils.

2) As a spring crop on good land it has little agricultural value, its growth being inferior to that of *V. sativa*.

3) It gives better results as an autumn crop and would probably be useful as a winter forage crop, being as resistant to cold as *V. villosa*.

4) Sown in the autumn and harvested as an early crop before the flowering period, *i. e.* about the end of May or beginning of June, it yields a crop as large as that of *V. villosa*.

The experiments are being continued on a large scale.

RUBBER, GUM AND RESIN PLANTS

521 – **On the Coagulation of the Latex of *Manihot Glaziowii*.** — MARX, T. in *Der Pflanzer*, Year X, No. 3, pp. 149-157. Daressalam, March 1914.

The writer shows that magnesium sulphate either alone or mixed with other substances is of no practical value. He criticises the use of certain coagulants such as the juices of the citrus and papaw, which introduce impurities difficult to remove by washing and which lower the quality of the rubber.

The experiments carried out at Amani on the use of calcium chloride in combination with other substances are summarised in the following table. The coagulants described as "good" may be used throughout German East Africa except in the coastal regions; those described as "very good" should be used in a solution diluted according to the local climatic conditions, the composition of the water, and the concentration of the latex.

No.	Composition of coagulant %	Coagulation	State of coagulum	Value	Remarks
1	calcium chloride . . 0.5 carbolic acid. . . . 0.5	poor	thick filaments with large nodules	none	
2	calcium chloride . . 0.5 acetic acid. 0.5	good	thick narrow strips	useful	
3	calcium chloride . . 0.5 carbolic acid. . . . 0.3 acetic acid. 0.15	poor	like No. 2.	useful in some cases	For use only on dry plantations
4	calcium chloride . . 0.75 acetic acid. 0.75	very good	thick and narrow strands	useful	
5	calcium chloride . . 1.0 carbolic acid . . . 0.25	poor	narrow threads	useful in some cases	
6	calcium chloride . . 1.0 carbolic acid . . . 0.3 acétic acid 0.15	good	like No. 2.	useful	
7	calcium chloride . . 1.0 carbolic acid. . . . 0.5	good	like No. 4.	useful	Too weak for young trees and wet districts
8	calcium chloride . . 1.0 acetic acid. 1.0	very good	like No. 4.	useful	
9	calcium chloride . . 1.0 acetic acid, ... 0.25	good	thick narrow strips well coagulated	useful	
10	calcium chloride . . 1.25 acetic acid 0.5	good	like No. 9.	useful	
11	calcium chloride . . 125 carbolic acid 0.5	good	like No. 9.	useful	
12	calcium chloride . . 1.25 carbolic acid 0.75	very good	like No. 9.	useful	
13	calcium chloride . . 1.5 carbolic acid . . . 0.25	very good	like No. 9.	useful	
14	calcium chloride . . 1.5 acetic acid. 0.5	good	like No. 4.	useful	
15	calcium chloride . . 1.5 carbolic acid. . . . 0.5	very good	like No. 9.	useful	
16	calcium chloride . . 1.5 acetic acid 1.0	very good	thick narrow strips easily separable	useful	Too strong for hot dry districts
17	calcium chloride . . 1.5 acetic acid . . . . 0.25 carbolic acid 0.25	very good	like No. 16.	useful	

522 – **The Coagulation of the Latex of *Hevea brasiliensis*, and its bearing on the Strength of Rubber.** — BARRITT, N. W. in *The Journal of the Society of Chemical Industry*, Vol. XXXIII, No. 6, pp. 289-293 + 4 figs. London, March 31, 1914.

Experiments on the behaviour of latex in solutions of varying concentration of acids and salts show that the coagulation of latex is analogous to the coagulation of protein solutions. Thus the coagulating effect of salts varies according to the basic radicle in the order of Hofmeister's series. Mineral acids up to a certain concentration increase the quantity of salt required to effect coagulation, but at higher concentrations less salt is required. With organic acids no limiting concentration was found above which coagulation took place without increase in concentration of salt.

Since the physical properties of proteins depend upon the concentrations of salt and acid with which they are in equilibrium, it seems very probable that the physical properties of plantation rubber are dependent on the concentration of the salts and acids in the latex at the time of coagulation. Thus, the addition of water and dilute acid would appear to be the cause of the variability and inferiority of plantation rubber compared with Fine Hard Para prepared by the Amazonian smoking method. The adoption of uniform methods of coagulation by acid on estates would not remove the variability of the product, owing to the natural variation in the composition of latex due to genetic and physiological differences in the trees and the influence of climatic variations.

The standardisation of plantation rubber, therefore, becomes exceedingly difficult and involves testing the product of each individual coagulating vessel.

VARIOUS CROPS

523 – **Precautions for the Growing and Transplanting of Liberian Coffee.** — FAUCHÈRE, A. in *L'Agriculture pratique des pays chauds*, Year 14, No. 131, pp. 81-83. Paris, February 1914.

The slow growth and late maturity of the Liberian coffee is attributed to the lack of care in the preparation of the nurseries and the transplanting of the young plants. By observing the following precautions the trees may come into bearing 18 months earlier.

Nurseries. — In order to be able to lift the plant with a ball of soil, the seeds should be sown in a clay soil at least 10 in. apart each way. There should be a nursery for each 25 acres of land, so as to avoid excessive transport, and each nursery should contain twice the number of plants required so as to allow for a careful selection.

Transplanting. — A plant 14 inches high should be lifted with a ball of soil 8 inches deep and 5 inches in diameter. Neglect of these conditions delays maturity from 1 to 2 years and endangers the life of the plants.

524 – **"Autumnal Flavour" of Tea.** – *The Indian Agriculturist*, Vol. 39, No. 3, pp. 71-72. Calcutta, March 2, 1914.

At the beginning of the cold season in the north of India the leaves of the tea plant undergo a change which gives the tea a very special aroma known as "autumnal flavour" and the leaves require a different treatment

from that during the rest of the year. The following method is the outcome of many years' experience.

The leaves are brought to the factory three times a day, at 12.30, 2, and 4.30 p. m., and are kept in a fresh state until 10 p. m. They are then rolled for half an hour, sifted and rolled again. Fermentation is allowed to take place during the night, and in the early morning the leaves are rolled again and dried. The whole process occupies only 10 hours. The increased expenses of the night labour are compensated for by the higher value of the product thus obtained.

525 – **Recognition of Tanning and Colouring Matters by Means of the "Mulhouse Band".** — BERTEAU, A. in *L'Agronomie coloniale*, Year I, No. 9, pp. 65-79. Paris, March 1914.

A simple process for the detection of tanning materials and dies has been investigated by the "Jardin Colonial" of Nogent-sur-Marne. It consists in the use of the "Mulhouse band"; this is a piece of cloth 8 inches wide, divided into five zones treated whith different mordants, with a small untreated piece between every two zones. The mordants are: 1) strong iron salts, 2) weak iron salts, 3) half iron, half alumina, 4) weak alumina salts, and 5) strong alumina salts.

Tannins, precipitating iron salts, show up specially on the first zones, which become tinted with some colour between black and brown or green; the true colouring matters show on the alumina zones.

The Mulhouse band is put into boiling water containing some of the substance to be examined; another band is treated in the same way, but using some standard tanning or colouring material. If, on comparing these two bands, it is found that the substance seems to contain valuable materials, it should be sent to some laboratory for proper analysis.

526 – **Problems Concerning the Utilisation of the Dum Palm in Italian Erythrea.** — BALDRATI, I. in *L'Agricoltura Coloniale*, Year 8, Nos. 2 and 3, pp. 85-107 and 182-200, + 4 figs. Florence, February and March 1914.

The exportation of the fruits of the dum palm (*Hyphaene*) from Italian Erythrea only attained any importance towards 1906, since when progress has been rapid, as is seen from the following figures:

Year	1907	1908	1909	1910	1911	1912	1913 (10 months)
Exports in tons	532	1693	485	3204	3832	3726	3655

Two types of fruit are distinguishable: 1) Oval in shape, with smooth surface; 2) elongated and irregular in shape, with protuberances. The second type has larger fruits and nuts with flat faces and is superior in industrial value. Each type includes two varieties: one with sweet fruits of a deeper red colour and heavier, the other with bitter fruits almost without pulp but more suitable for producing vegetable ivory.

The dum palm groves in Erythrea are only of recent formation and are extending rapidly. The spread of this palm is effected by means of elephants; the entire fruits are consumed and the kernels germinate after

passing through the animals. The spread has also been promoted by the periodical emigrations of the Beni Amer tribes.

It has been feared that the exportation of the fruits would interfere with the natural reproduction of this palm, but the writer points out that such fears are groundless considering the importance of propagation by mean of suckers ; groups of palms of the same sex and derived from one plant are frequently found in the forests, and propagation by means of suckers is preferred in the formation of new plantations.

Since one male tree is sufficient to pollinate ten female trees, it is important to be able to identify the sex of a tree before flowering. According to GRANT and BECCARI the males are recognised by the foliage covering the trunk, whilst the females have bare trunks. The writer finds this not to be the case, and distinguishes the sexes according to the size of the leaves and number of segments as follows :

	Male inches	Female inches
Leaf blade	47–51	58–70
Petiole	39–47	47–62
No. of segments . . .	71–79 (always odd)	80–86 (always even)

At a distance, the leaves of the female trees may be recognised by their numerous leaflets and the incurving of the lower part.

Regular and abundant rainfall produces an abundance of flowers and a good yield appears to be dependent on the wind. As a rule good and bad harvests alternate :

1907	harvest	very poor	1911	harvest	poor
1908	»	very good	1912	»	good
1909	»	good	1913	»	medium.
1910	»	very good.			

The exact age at which this palm begins to fruit is not known, but the writer considers it is two or three years later than in the case of the date palm. Although often cited as a xerophyllous plant, this palm is only found in luxuriant growth in deep alluvial soils periodically inundated. The plantations require protection against the ravages of fire, monkeys, parrots and the natives.

The yield varies from 4600 to 7600 lbs. per acre of 40 to 50 female trees. If the number of male trees were reduced to one for every ten females, the number of female trees would be increased to from 70 to 100 per acre and the yield increased to an average of 13000 lbs., corresponding to 4600 lbs. of kernels.

The cost of the nuts at Genoa amounts to £7 to £9 per ton.

The writer concludes by an account of the different uses of the dum palm and the improvements to be made in its utilization.

527 – **Field Cultivation of Capsicum in Meglena, Hellenic Macedonia.** — *Communication from* PANAYOTIS A. DÉCAZOS, *Chief of the Department of Agriculture of Macedonia* (*Salonica*).

Capsicum powder, or " red pepper ", is used throughout the Balkan countries (Turkey, Roumania, Bulgaria, Servia) and in Hungary, especially by the agricultural population, as a condiment in the preparation of food. The most esteemed products of capsicum are those with the " hottest " flavour; these are produced almost exclusively in Meglena (Turkish, Karadjova), Hellenic Macedonia, in which valley this cultivation predominates and is so extensive as to be considered an agricultural rather than a horticultural industry.

The fertile soils of this valley are derived chiefly from argillaceous schists and limestones and are loamy or sandy with considerable percentages of lime and organic matter. The majority of this land is irrigable from the 15 small streams which flow through it.

The climate is Mediterranean (1) and warmer during the winter than that of Monastir and Norina in the same latitude, owing to the surrounding mountains (2) which shelter it from the cold north and north-east winds, while the summer temperature remains cool owing to the currents of cold air from these same mountains. The atmosphere is very moist throughout the year, owing to the abundant rainfall and numerous streams.

The population of Meglena is about 125 per square mile and is ample to supply the labour requirements of this crop.

Rotations. — Capsicum follows maize or French beans in either of the two following rotations :

wheat	wheat
maize	maize
capsicum	French beans
	capsicum.

(1) The climatic conditions of Meglena are probably between those of Salonica and Monastir, which, according to DUPUY (Monastir 1899-1903) and to some observations of the Agricultural College at Salonica (1906-1910) are as follows:

Month.	Temperature, °C.		Rainfall in mm.	
	Salonica	Monastir	Salonica	Monastir
May	20.56	17	43.6	68.0
June	24.20	19	16.1	71.0
July	25.23	23	29.0	49.0
August	24.21	22	38.0	40.0
September	17.50	18	37.0	29.0

(2) For an account of the geological and physical conditions, see CVIJIĆ, Geographie und Geologie von Mazedonien und Altserbien. — *Petermanns Mitteilungen, Erganzungsheft* No. 162, p. 224 et seq. (Morichovo und Meglen). Gotha, 1908.

A three- or four-course rotation is necessary to maintain the fertility for this crop, and to check the progress of underground pests. On account of the large amount of labour required, it is a suitable crop for the small holder and for countries where labour is cheap and plentiful.

Cultivated varieties. — During the half century in which this crop has been grown on a large scale in Meglena, many varieties have originated and become adapted to the particular conditions of climate and soil in which they are grown. Each variety yields a product of special type of more or less good quality, varying according to the locality. Experiments have shown that these Meglena varieties lose a considerable part of their quality and piquancy when grown in other countries or even in neighbouring districts. The Grecian occupation being very recent, it has not been possible to study the relative conditions from the scientific point of view. It is only known that the products of highest quality come from the villages of Neochore, Fressino, Poziar and Stroúpino.

Two of these varieties are distinguished as common and sweet capsicum respectively.

Common capsicum is of commercial importance and is preferred by the cultivators on account of its higher yield. The fruits are very conical in shape with a length of 2 ½ to 4 inches, and a diameter at the base of ¾ to 1 ½ inch. The skin is rather thick, and 4 to 8 lbs. of fruit, according to the moisture content, are required to yield 1 lb. of pepper. This variety grows to height of 16 to 24 inches, and each plant produces only 40 to 50 fruits, owing to the reduction in irrigation during the season. The annual production of common capsicum reaches 2 to 4 million lbs. and increases each year.

Sweet capsicum. — The fruits of this variety are almost as large as those of the above, but the skin is thinner and the product is both piquant and sweet. It is cultivated only in the villages of Bakovo, Csernezi and Stroupino. At least 8 lbs. of dry fruits are required to produce 1 lb. of pepper, and although it realises higher prices in the market, it is a less profitable crop to cultivate than the common capsicum. The annual production reaches only 10 000 to 90 000 lbs. of pepper. Experiments have shown that the seeds of this variety grown in other villages produce plants with the characteristics of the common variety.

Preparation of nurseries. — The seeds are not generally sown in the open but in a cold pit, and afterwards transplanted. A sheltered plot is chosen and dug to a depth of 12 to 20 inches at the beginning of April. The surface soil is mixed with well decomposed manure and the seeds sown thickly towards the end of April. A thin layer of finely divided manure is then spread over the surface and the bed watered each evening until the majority of the plants have appeared. Later, waterings are given every 5 or 6 days according to the weather. Two days before transplanting they are given a thorough watering to facilitate the lifting of the plants. The seedlings are kept hoed and thinned to promote strong growth, and if at the time of transplanting they appear backward, a dressing of pigeon guano is given in the seed-bed.

Preparation of the land and planting out. — The best soils for capsicum are loams or sands containing humus, and capable of irrigation. The land is ploughed, and then harrowed five or six times to reduce it to as fine a texture as possible. It is then ridged and the irrigation channels cleaned out. Planting out takes place during June when the plants possess 4 or 5 leaves. The soil is irrigated and the plants are dibbled by hand in holes 6 to 8 inches apart on the ridges, which are 16 inches apart.

Irrigation and weeding. — After transplanting, the soil is irrigated every 3 or 5 days until the success of the plants is assured. The first weeding takes place a fortnight after the last irrigation, unless weeds are much in evidence before this time. When the plants are established, irrigation is withheld until the leaves show signs of drought. This point is of considerable importance, since irrigation at this stage may greatly injure the quality of the product, the piquancy being partially or wholly destroyed. Three or four days after this second irrigation the land is hoed again deeply and the plants earthed up. The next irrigation is made after the capsules have formed and before the plants appear as wilted as for the previous irrigation. If necessary, a final weeding is made, and then the plants are irrigated every 4 or 5 days.

Harvest and drying of the fruits. — The capsules are harvested during September and early October when they have assumed a dark red colour and when nearly all their moisture has evaporated. The ripening of the fruits takes place at intervals, and the harvest is generally divided into three periods according to the stage of ripening. In some villages with a warmer climate, where the autumn frosts come later, the crop is often all picked at one time at the beginning of October, when the majority of the fruits are very ripe and have acquired a better colour and a higher market value.

The fruits from the first picking may be dried in the sun if conditions are favourable, but generally they are dried in a special drying shed, containing a perforated wooden platform fixed at 55 to 60 inches from the floor. The capsules are dried on this in a layer not more than 20 to 24 inches thick, lest the colour and quality of the product should be damaged. Owing to risk of fire in houses, special drying sheds are generally used. Wood fires are used, the smoke of which develops the colour of the product. The process lasts from 7 to 17 days, and with slow drying at relatively low temperatures a finer product is obtained. The drying is said to be complete when the fruits are very fragile, and crackle. In order to completely dry the fruits, including the thick placenta, they are covered over and the temperature is raised for 48 hours. They are then collected, broken into small fragments by means of a stick and taken to the flour mills, where they are ground on a soft millstone.

Yield and returns. Control of purity.— The average yield of red pepper is from 1300 to 2200 lbs. per acre ; from 5 to 8 lbs. of capsules are required to produce 1 lb. of common capsicum and from 8 to 10 lbs. for each lb. of sweet capsicum. Sometimes the broken dried fruits are sold under the name of "boúcovo". The price of the powder fluctuates between

2 ¼ *d* and 4 ½ *d* per lb. The largest market is Edessa (Vodena) in Hellenic, Macedonia, where it is sold in bags of 100 kg. (220 lbs.).

The best quality of red pepper has a bright rose-red colour, the dark red and reddish-green varieties being the inferior grades. The bright red colour is obtained by sun-drying or by slow continuous drying. If the fruits have been touched by frost before picking, they develop a greenish colour and loose their piquancy. Attempts to improve the appearance of the inferior grades by chemical treatment, have been prevented by the action of the Turkish Government during the last ten years. Before export the product is inspected at a central depot where a small sample is taken from each bag and tested for colouring matter by making an alcoholic extract and evaporating a little on a sheet of clean cigarette paper. Any chemical treatment of the product shows itself in different coloured stains on the paper, while the pure pepper gives a uniform pale red. All adulterated products are confiscated and destroyed, and the bags which are certified as pure are specially sealed to avoid their being opened before reaching their destination.

The cost of growing capsicum, including the drying, is £9 10*s* to £11 per acre, while the gross returns are from £13 to £17 10*s*.

528 – **Warm Baths for Forcing Strawberries.** — BALTEL, G. in *Revue Horticole*, Year 86, No. 9, p. 212. Paris, May 1914.

Young plants are obtained by rooting runners in small pots early in June and then planting out in the open. They are repotted in September and sheltered when necessary. Before forcing in November and December a small pad of straw or hay is placed round the neck of the plant and tied on so as to prevent loss of soil when the pot is inverted. The pots are then inverted on an iron grid over a tank of water at a temperature of 32 to 35° C. (89° to 95° F.) so that the leaves are submerged. After treatment in this way for from 6 to 8 hours, the plants grow more rapidly, produce more flowers and give a better yield of fruit.

FRUIT GROWING.

529 – **Recent Work of the Royal Hungarian Central Ampelological Institute at Budapest.** — *Communication from* DR. GYULA DE ISTVÁNFFI, *Professor at the University and Director of the Institute.*

1). *Research on mildew in vines.* — Experiments have been conducted for more than 10 years ; a new line was taken up in 1911 with the institution of infection experiments. A summary has been published in Hungarian, of which a French translation appeared in the *Annales de l'Institut ampélologique* (1). The chief results have already been published in the *Bulletin of Agricultural Intelligence and Plant Diseases* (2).

2). *Researches on the relation between climatic conditions and mildew.* These have been completed after five years' work, and indicate the meteorological conditions favourable to the development of mildew, the course

(1) GY. DE ISTVÁNFFI and GY. PALINKÁS : Études sur le Mildiou de la Vigne. Vol. IV, 1913, June, pp. 1-122, pl. I-IX. Budapest, 1912.

(2) See No. 1208, *B.* Oct. 1913. (*Ed.*).

of the propagation of the disease during several years and the means of forecasting outbreaks (1).

3). *The Intelligence Department for reporting the spread of mildew.* — Established in 1911 on the initiative of the Director of the Institute. Data are collected with the assistance of diseased specimens sent to the Institute. Reports are published weekly in the papers indicating the districts where the climatic conditions are favourable to the outbreak of the disease. This work has made the Institute popular and considerably strengthened its work.

4). *Information relating to defensive measures* (with coloured illustrations). These appeared in 1912 in new publications; of the articles relating to the control of mildew 12 000 copies were distributed in 5 700 vine-growing districts.

5). *Experiments in the control of mildew.* — The agricultural value of ten remedies used in various countries was determined in two series of experiments carried out in 8 and 10 State vineyards respectively. The Institute undertakes the testing of all acceptable remedies during a period of three years under the most varied climatic conditions.

6). The origin of " bramble-leaf ", frozen stocks, the preparation of grafts, their treatment and preservation from a mycological point of view, have been studied. The publication of this work was completed during 1913.

7). *Researches on the degeneration of vineyards in certain districts.* — Considerable work was done during 1912-13, especially in the sandy region of the Alföld. The subject was studied from the point of view of anatomy, biology, pathology, meteorology and pedology. The chief causes of the degeneration are drought, frost, exhaustion of the vines, neglect, and damage due to atacks of cockchafer grubs and phylloxera. Good results have been obtained in the experiments in the mountain districts of Tokay-Hegyalja and at Somlyóhegy. A collection of phytopathological studies is in course of preparation, together with an account of the methods of examination used by the Institute.

8). *The control and examination of the means of destruction* is one of the most important works of the Institute, and deals with all the remedies in use. In 1912, 103 specimens were examined and 360 determinations made. The biological and phytopathological effect of new remedies is previously tested on vines under glass before experimenting in vineyards. Experiments have also been made on the use of carbon tetrachloride against phylloxera in four vineyards. Spraying materials have been tried in 8 cases and 142 determinations made, and the value of the " Tempus " sprayer was also determined in the experiment fields of the Institute at Köbánya.

9). *Studies on defects of wines* are in course of publication. They relate to : *a*) the examination of acetification of wines, brought about by 26 different acetifying bacteria ; the best varieties for the production of vine-

(1) See No. 68, *B.* Jan. 1913. (*Ed.*).

gar were chosen ; *b*) detailed researches on lactic fermentation, which, according to results obtained at the Institute, is the cause of numerous defects of wine ; *c*) the examination of the organisms of must, showing that the organisms causing the diseases of wine are already present in the must ; this led to an examination of the sulphuring process and the fermentation of the must by yeast ; *d*) the study of the flavour of Hungarian wines known as " levegö iz " (air flavour), which has shown that yeasts play an important part in producing substances which influence the flavour and aroma of wines.

10). *The practical application of yeast cultures.* — After studying in detail the action of the various yeasts in the chief vine-growing districts, the Institute placed these yeasts at the disposal of wine-makers in 1912 and 1913. The yeasts included : 1) those producing a high alcohol content, for " Aszu " wine ; 2) organisms giving a good fermentation even at low temperatures ; 3) organisms settling to the bottom of the liquid and suitable for champagnes ; 4) organisms capable of fermenting must containing a considerable quantity of sulphurous acid ; 5) highly resistant organisms ; 6) organisms which rapidly form a thick scum when alcoholic fermentation is complete ; 7) organisms for fermenting red wines. Some 45 000 gallons of must were fermented, and in the majority of cases better wines with higher prices were obtained. In the autumn of 1913, this procedure was continued on a larger scale. As the result of experiment it was found that the best condition for despatching the yeasts was absorbed in sterilised cotton wool, in which condition they retained their vitality after 4 or 5 months.

A description of the properties of the 54 varieties of ferments so far selected, and a determination of the maximum quantity of alcohol produced in musts of different concentrations of sugar, are in course of progress.

11). *Experiments in vine-growing* are being carried out in State vineyards in different districts, with the object of determining the most suitable time for pruning ; these experiments will be terminated in 1915, after six years' duration. At the same time the composition of the bleeding sap is determined by chemical analyses (34 in 1912). Hengl's new grafting machine was also tried from the point of view of perfecting the work, and as a result of the anatomical examination of the joint and the graft it was concluded that this machine could not efficiently replace hand grafting on a large scale.

12). *Manurial experiments* to compare the value of different excreta have been carried out since 1909. In 1912 additional experiments were begun, comprising 360 chemical analyses of 86 samples of must. Further, analyses have been made of the fertilising value of grape pomace, tobacco refuse, brewers' hops, sawdust, etc. Experiments with chemical manures in 1912 were designed to establish the most suitable mixtures for large areas of soil types ; these experiments are being conducted at present in 7 districts.

13). Experiments with different types of stakes have been made.

14). Smudging against frost has been tried in four State vineyards.

15). *Experiments with hybrid stocks.* — Nine experiment fields were started in 1912 in various localities of Hungary, and others are contemplated. Three nurseries have been established in different districts for the propagation of stocks. Observations have been made of 70 plantations of hybrids in 12 different counties, with respect to the suitablity of hybrids to certain conditions of soil, particular attention being paid to the difficulties of treating the soil with carbon disulphide. Various binding materials, such as raphia, bast and jute, have also been tried.

16). The *Hungarian Ampelography*, describing all the more important vines, with colour-photographs, is nearing completion.

17). *Publications.* — The *Annuaire* has been discontinued, and popular articles are published in *Borászati Lapok*. Vol. IV. of the *Annals* containing only techinical articles has appeared, and the French edition will soon be out.

18). *Vine-growing and meteorological stations.* — There are 11 of these at work under the Institute ; the results given by them, especially as to mildew, have been very useful. Their climatological data for 1901-08 have recently been published under the title of *Réthy Antal* (142 pp.).

19). *Observations on the development and phenology of the vine* were carried on by means of schedules in 1912 ; the observations now extend over twelve years.

20). *Ampelographical Collection.* — This is situated at Kőbánya, near Budapest ; it contains 600 varieties . The Institute also possesses a vineyard near Orsova, far from any vine district, where imported varieties are increased ; these are then used for hybridization, chiefly to obtain adaptable stocks.

21). The information department replied, in 1912, to 3385 enquiries on all branches of vine-growing and wine-making.

530 – **The Growth of the Roots of the Vine and its Importance in the Manuring and Cultivation of the Soil of Vineyards.** — KROEMER in *Zeitschrift für Weinbau und Weinbehandlung*, Year 1, Parts 1 and 2, pp. 37-46 and 70-81. Berlin, 1914.

The writer describes the development of the root-system of the vine, particularly the active portion, and its relation to the physical properties of the soil. He concludes that the most favourable conditions for the development of the active root system occur in the upper layer of soil and that the deeper root system is concerned with the absorption of water rather than food material, though the more soluble constitutents, such as the nitrogenous ones for example, may also be absorbed by these deep roots.

Consequently the removal of superficial roots as generally carried out is injurious to the plants, and appropriate cultural methods ought to be employed instead which would encourage the development of surface roots in addition to the deeper root system.

For the first few years after planting the soil should be cultivated deeply while the deep root system develops. In older vineyards on fairly moist soil the superficial root system can then be stimulated without danger to the plants, and care should be taken not to disturb the surface soil

by carrying out only very shallow tillages. The same treatment may be adopted in the case of soils with a high water-table. On the other hand, in light, permeable dry soils with a low water-table, and especially in districts of low rainfall, deep cultivation should still be practised to develop a deep penetrating root system.

531 – **Protection of Vines against Spring Frost.** — LUR-SALUCES in *Bulletin de la Société des Agriculteurs de France*, Year 16, pp. 265-267. Paris, April 15, 1914.

A system of protection against spring frosts was organised in the district of Sauternes (Gironde) in 1913, with good results. The land of each commune was divided into a number of sections ; in each commune one of the growers volunteered to give the alarm: he fires a cannon at nightfall if a frost seems likely, then three shots when the fires are to be lit, and three more in the morning when the temperature rises above freezing-point.

Fire places are fixed in the alleys of each section at intervals of 10 to 30 yds., and besides them one cauldron on wheels is supplied for every 12 acres or so ; this moves up and down in a cross shape. The cauldron is half full of coal tar, which is lit by means of pine branches ; it is occasionally sprinkled with water to increase the denseness of the smoke. The fixed fires are made of green pine branches, litter, green grass, etc. By this means a very dense smoke was obtained, so that it was difficult to find one's way about ; this completely prevented further radiation from the ground. In case there is much current of air, it is well to have extra cauldrons producing smoke on the windward side.

At Preignac, in 1913, the cost of smudging on three mornings in April for about 5 hrs. each was about 3*s* 6*d* per acre for materials alone.

532 – **The World's Trade in Bananas.** — MACFARLANE, JOHN I. in *The Tea and Coffee Trade Journal*, Vol. XXVI, No. 3, pp. 226-230 + 6 figs. New York, March 1914.

1. — *Importing countries.* — *United States.* This country is the world's greatest consumer of bananas. During the fiscal year ending June 30, 1913, $ 28 657 084 worth of fruit were imported, more than half of which consisted of bananas. The latter were imported chiefly from the regions bordering the Caribbean Sea, as shown in the following table :

Imports of Bananas to the United States, 1912-13.

	No. of bunches	Value
		$
Jamaica	11 163 269	3 488 498
Honduras	7 983 591	2 435 006
Costa Rica	6 973 684	2 744 813
Panama	4 438 300	2 082 502
Guatemala	2 359 250	600 041
Columbia	2 684 749	1 107 429
Cuba	2 213 733	834 206
Nicaragua	1 681 944	348 064
Mexico	1 541 504	412 315
British Honduras	651 054	163 249
S. Domingo	475 500	222 626
Guiana	184 498	39 932
Grenada	4 398	4 111
Other regions of the West Indies	1 625	466
Total	42 357 109	14 484 258

Half of the bananas imported to the United States enter through the port of New Orleans, which receives more bananas than any other port in the world and possesses special facilities for landing the fruits.

The value of the bananas imported to *Europe* is almost equal to that of the United States, but the quantity is only about one-third. England, France and Germany are the most important consumers in Europe.

England is second to the United States in imports of bananas, which are increasing rapidly.

	No. of bunches	Value $
1900	1 287 000	2 740 000
1912	6 978 876	9 587 000

Germany imports 35 226 000 kg., valued at $2 525 000, while *France* received 21 749 000 kg., valued at $1 219 000.

II. *Exporting Countries.*— *Jamaica* comes first in the exportation of bananas:

1911	16 947 385 bunches
1912	13 382 072 »

The decrease in 1912 is attributed to accidental causes.

Costa Rica comes second, with an export of 10 647 000 bunches, and shows an increasing production.

Honduras is rapidly increasing her exports to the United States, and *Panama* has doubled her exports during the last ten years.

The *Canary Is.*, which were formerly the chief exporters to Europe, maintain their exports at about 2 723 000 bunches.

533 – ***Citropsis*, a New Tropical African Genus allied to *Citrus*.** — SWINGLE, WALTER and KELLERMAN, MAUDE in *Journal of Agricultural Research*, Vol. I, No. 5, pp. 420-436 + 7 figs. + 1 plate. Washington, February 1914.

The fruits of *Citropsis* are known as "African cherry oranges"; they are produced in clusters from the axils of the leaves. The writers consider it necessary to establish a new genus to include these African species, and they do this by raising the section *Citropsis* of Engler to generic rank. The following species are described: *C. Preussii* (Engler), *C. Schweinfurthii* (Engler), *C. gabunensis* (Engler) and *C. mirabilis* (Chev.), as well as *C. articulata* (Willd.) which is not well known.

The members of this genus are worthy of the attention of agriculturists, since several of them produce an abundance of delicious fruits. *C. Schweinfurthii* has given good results on poor sandy soils in Florida. It is hoped that the numerous small fruits may be increased in size by hybridization with *Citrus*; successful crosses have already been obtained.

LIVE STOCK AND BREEDING.

HYGIENE

534 – **Research on the Life History of the Large Warble Fly** (1) **and Means of Controlling it.** — LUCET, ADRIEN in *Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences*, Vol. 158, No. 13, pp. 968-970. Paris, March 30, 1914.

The writer communicates further investigations into the life history of the large warble fly. The adult fly lives only until it has mated and deposited its eggs.

In eleven flies, observed by the writer, the average duration of life was from four to five days. During this time the fly does not seem to take food. It does not appear either to travel any distance from the place where it was hatched, flying only in fine, warm weather, and not moving is the mornings, evenings or cool wet weather. The number of eggs which were found in the bodies of four females were : 372, 386, 357 and 343, which is less than the number found by GLÄSER. Recently-laid eggs contained the larvae already clearly formed.

Neither placing adult flies on the neck and back of an ox nor enclosing the ox with some flies in a cage for several days appeared to alarm the animal, from which the writer is led to believe that the gadding of cattle is not caused by warble flies.

The writer also undertook experiments for the control of warbles and obtained very satisfactory results with tincture of iodine prepared according to the pharmacopoea. An injection of 0.5 and 1 cc. of pure or diluted tincture of iodine (Gram solution) practised on the swellings of two oxen had the result of killing all of the 81 larvae they contained. These experiments were to be continued in May in the Département of Ariège.

535 – **Practical Observations on Contagion in Anthrax of Cattle, on the Diminution of Cases by Vaccination and on Uniform Immunization.** — VIASZ, J. in *Allatorvosi Lapok*, XXXVI, No. 30, pp. 355-358. Budapest, 1913.

The writer reports on his results obtained from the dissection of 1200 cattle and from the clinical observation of about 250 diseased ones. Contrary to the generally accepted opinion, according to which the food is credited with being the chief source of contagion, the writer believes that at least 80 per cent. of the cases are due to the drinking water. In support of his opinion he mentions instances of large estates and communes in which only the animals that drank the water from certain sources fell ill and the disease disappeared as soon as these sources were closed. Infection by wounds in the skin is possible, but it is so rare that it can be practically neglected. Where, on the contrary, infected water exists, the disease may attack stall-fed animals also, and exceptionally even buffaloes.

As for the age, it has been observed that in such localities not only steers contract the disease, but also calves immediately after weaning, and this so frequently that they must be regularly vaccinated at that time. In order

(1) See No. 144, *B.* Feb. 1913; No. 251, *B.* March 1914; No. 445, *B.* May 1914.

to avoid cases of sickness due to the inoculation, it is recommended to grind very fine the powdered matter used for vaccinating, as by this means it can be more exactly dosed. Only the matter obtained from the liquid contained in the swellings is suitable for this purpose, as that obtained from the muscles cannot be reduced to a uniform powder.

Observing this method, 5000 head of cattle have been inoculated in the course of eight years without any losses, and only in the ninth year did two deaths occur shortly after inoculation.

For the treatment of diseased animals intravenous injection of hydrogen peroxide, followed by the incision and washing out of the swellings, is recommended. As a prophylactic measure immediately on the outbreak of the disease, a search should be made for infected wells or other sources of water.

536 – **Swine-pox in Young Pigs.** — BÁN, E. in *Állatorvosi Lapok*, Year XXXVI, No. 52, pp. 620-621. Budapest, December 27, 1913.

The existence of swine-pox was until recently considered doubtful. Chauveau, Gerlach and R. Koch had, however, demonstrated that cow-pox can be artificially communicated to pigs, but under natural conditions the disease had hardly ever been observed. In 1906 Száutó proved that pigs, especially sucking ones, sometimes contract the disease and that they communicate it to healthy animals by merely living with them. Since then, from year to year the number of observations has increased and it appears that in many districts of Hungary the disease is fairly frequent, that it attacks some herds every year and that sometimes it causes considerable losses. This is especially true of districts on the right bank of the Danube, where, according to the writer's observations, it is one of the most frequent diseases of sucking pigs. Generally it develops so insidiously that the owner is only aware of its presence when a proportion of the weaned pigs are arrested in their development or some of them die. When the herds are once infected it is very difficut, as with cow-pox, to free them again, even making use of repeated disinfections.

The disease is accompanied by severe itching, which leads to the production of an eczema. The course of the attack is generally mild, but sometimes serious losses occur, mostly through complication with intestinal catarrh or chronic catarrhal pneumonia. In one herd the necrosis of the teats was observed, but it is not certain that this complication was caused directly by the disease. Protective inoculations with cow-pox lymph gave good results in several localities on about 400 young pigs. Small nodosities were formed at the place of inoculation, but otherwise the animals' health was in no wise impaired. In one case, a few pigs developed small pustules on the inner side of the thigh, where they had been inoculated, and after 6 or 8 weeks all the other animals fell ill, but not seriously. It is not impossible that these inoculations, which of late have been more frequently practised, may have contributed to the spread of the disease.

537 – **Causes and Effects of Cryptorchism.** — ZSÁMÁR, GEORGE in *Állatorvosi Lapok*, Year XXXVII, No. 6, pp. 61-64, No. 7, pp. 74-78, No. 8, pp. 90-95. Budapest, February 7, 14, 21, 1914.

With the object of throwing more light on the question of the procreative power or the sterility of cryptorchids, the writer subjected eight testicles which had been retained by monorchid horses to a rigorous histological investigation as to their sperm-producing capacity.

The result of his investfgations can be summarized as follows: Independently of whether the testicles had been retained in the abdomen or in the inguinal canal, and of the age of the animal within the limits of 2 to 3 years, the germinative cells in the tubuli are represented only by earlier stages of development, as spermogones or at most spermocytes. Such testicles therefore resemble normal testicles in young animals, with the essential differences that in the former degenerative processes point to the cessation of development, while in the latter the conditions for further development exist. The degeneration concerns more the germinative cells than Sartoli's cells, while the so-called plasm cells on the contrary seem more numerous.

The formation of sperm in the retained testicles does not reach the degree of being vital and fertilizing; consequently stallions that are completely cryptorchid must be considered as sterile and monorchid stallions as owing their generative power only to the testicle which has descended normally into the scrotum.

If the male sexual characters are well marked in completely cryptorchid horses, this is explained by the fact that the so-called plasm cells which produce the inner secretion have not suffered any degeneration.

538 – **Sugar in Blood Plasma.** — BIERRY, H. and FANDARD, L. in *Comptes rendus hebdomadaires des séances de l'Académie des Sciences*, Vol. 158, No. 1, pp. 61-64. Paris, January 5, 1914.

The blood of horses, chickens and dogs was examined for sugar, and it was found that venous plasma was always richer in sugar than the corresponding arterial plasma.

ANATOMY AND PHYSIOLOGY

539 – **Influence of Fluorine on the Animal Organism.** — SCHWYZER, F. in *Biochemische Zeitschrift*, Vol. 60, Part I, pp. 32-42. Berlin, February 14,1914.

Experiments with rabbits led the writer to conclude that fluorine introduced into the body caused a loss of lime, chlorine and fat from the bones; even in daily doses inferior to one millionth of the live weight it acts as a poison, and consequently is strictly to be avoided for preserving mashes for live stock and similar uses.

FEEDS AND FEEDING

540 – **The Food Value of Certain Grasses.** — GRÉGOIRE, A. and CARPIAUX, E. in *Rapports et Communications du Ministère Belge de l'Agriculture et des Travaux Publics*, No. 8, pp. 5-48. Brussels, 1914.

The following grasses, Italian ryegrass (*Lolium italicum*), English ryegrass (*Lolium perenne*), tall fescue (*Festuca elatior*), tall oat grass (*Arrhenatherum elatius*) and timothy (*Phleum pratense*), were investigated from two points of view: 1) their food value, and 2) the assimilation by the animal of lime

TABLE I. — *Chemical composition of hay (per cent.).*

	Dry matter		Crude protein		Crude fat		Nitrogen free extract		Crude fibre		Ash		Pure protein		Phosphoric acid		Lime	
	Grégoire	Pott (mean)	Grégoire	Pott (mean)	Grégoire	Pott (mean)	Grégoire	Pott (mean)	Grégoire	Pott (mean)	Grégoire	Pott (mean)	Grégoire	Pott (mean)	Grégoire	Pott (mean)	Grégoire	Pott (mean)
Italian ryegrass:																		
1st cut (Sep. 8, 1908) . . .	85	86.8	8.76	9.9	2.5	3.1	44.61	43.4	20.21	22.9	9.38	7.5	7.93	—	0.814	—	0.728	—
2nd » (June 15, 1909) . . .	85		4.43		0.98		50.20		24.00		5.40		3.77		0.456		0.418	
English ryegrass:																		
1st cut (Sep. 8, 1908) . . .	85	86.0	10.18	9.1	2.32	2.0	39.72	34.7	23.42	33.8	9.36	6.4	8.95	—	0.921	—	0.683	—
2nd » (June 15, 1909) . . .	85		5.24		1.16		46.51		25.76		6.33		4.21		0.513		0.417	
Tall fescue:																		
1st cut (Sep. 8, 1908) . . .	85		10.51		1.97		43.30		21.56		7.67		9.17		0.761		0.586	
2nd » (June 15, 1909) . .	85	85.7	6.91	8.0	2.25	2.3	43.34	42.3	24.67	26.0	7.83	7.0	5.99	—	0.573	—	0.354	—
3rd » (July 12, 1909) . . .	85		5.55		2.12		39.97		26.55		10.52		4.26		0.462		0.354	
Tall oat grass:																		
1st cut (June 3, 1910) . . .	85	86.8	5.07	6.2	1.18	1.9	34.97	41.7	35.13	29.5	8.65	7.6	4.30	—	0.534	—	0.282	—
2nd » (Sep. 6, 1912) . . .	85		5.47		1.38		37.51		31.89		8.77		4.39		0.633		0.378	
Timothy:																		
(July 13, 1910) . . .	85	87.3	4.54	7.6	0.72	2.3	45.20	45.3	27.90	27.4	5.92	4.7	4.22	—	0.388	—	0.371	—

TABLE II. — *Results of digestibility trials.*

Kind of hay	Percentage digestibility: mean of 3 sheep.					
	Dry matter %	Organic matter	Crude protein	Crude fat	Nitrogen free extract	Crude fibre
Italian ryegrass:						
Cut young	82.15	74.6	56.4	53.4	79.1	73.7
Cut in flower	80.32	58.7	26.4	36.4	68.0	46.2
English ryegrass:						
Cut young	80.06	76.0	62.1	53.1	80.6	76.6
Cut in flower	80.93	59.8	40.9	48.9	64.7	55.1
Tall fescue:						
Cut young	83.28	70.7	63.2	55.9	75.4	67.7
Cut in flower	84.42	63.3	53.6	73.0	64.3	53.5
Cut after flowering	87.84	56.7	51.0	82.6	62.1	47.0
Tall oat grass:						
Cut young	85.47	57.8	46.5	52.3	54.4	63.9
Cut in flower	85.90	56.4	43.7	48.7	47.5	66.3
Timothy:						
Cut after flowering	83.93	54.4	37.1	60.1	62.5	43.9

and phosphoric acid contained in the grasses. The first three were sown on an old experimental field at Gembloux in May 1908; no manure was applied, a good set was obtained and the first crop cut in September 1908 under good weather conditions. In April 1909 the plots received 180 lbs. of nitrate per ace, and half of each plot was cut on June 15, the hay being got up in good condition, while the other half was not cut till later and made in bad weather. The other two grasses were also sown on an old experimental field at Gembloux, but on land in good heart. Seed was sown in 1909 and came up normally; 180 lbs. of nitrate were applied in April. A good crop of tall oat grass was obtained, but only a moderate one of timothy.

Food value of hay. — Feeding trials were carried out on sheep in KÜHN feeding boxes similar to those in use at the Möckern Experimental Station; the faeces and urine were also collected by the same system as employed at Möckern. The trials lasted a fortnight after a preliminary preparatory period of a week. The hay was chaffed and carefully mixed with other foods, samples being analysed by Belgian official methods with slight modifications. The results are tabulated in Table I and compared with those obtained by POTT for similar plants.

The two sets of figures are somewhat different: the two kinds of ryegrasses and timothy contain less albuminoids and the two former more nitrogen-free extract than POTT's samples and the percentage of fibre in English ryegrass in also lower; tall oat grass is poorer in nitrogen-free extract

TABLE III. — *Average amount of total organic matter and digestible matter (and their starch value) provided per day and per* 1000 *kilog. live weight in the different kinds of hay (in kilog.).*

Kind of hay	Total organic matter	Digestible material				Starch Value
		Crude protein	Crude fat	Nitrogen free extract	Crude fibre	
Italian ryegrass:						
Cut young	15.984	1.043	0.231	7.456	3.037	8.3
Cut in flower	14.200	0.209	0.064	6.105	1.975	5.7
English ryegrass:						
Cut young	15.448	1 293	0.252	6.533	3.667	8.4
Cut in flower	14.642	0.398	0.105	5.607	2.647	5.9
Tall fescue:						
Cut young:	16.298	1.400	0.233	6.884	3.080	8.8
Cut in flower	15.285	0.729	0.328	5.452	2.602	6.4
Cut after flowering	15.823	0.583	0.425	5.303	2.656	5.8
Tall oat grass:						
Cut young	15.172	0.506	0.143	4.028	4.053	5.0
Cut in flower	13.316	0.386	0.100	2.826	4.055	3.8
Timothy:						
Cut after flowering	15.502	0.309	0.159	5.184	2.239	3.9

but richer in cellulose. These differences show how the composition of hay may vary from year to year and the very approximate value of figures in recognised tables.

Results of digestibility trials are given in Table II, and in Table III the average amount of total organic matter and digestible material (together with their starch values) provided in the rations per day and per 1000 kilog. live weight.

KELLNER's maintenance ration for an adult sheep is as follows :

Dry matter	18.23	kilog.
Crude digestible protein	1.20	»
» » fat	0.20	»
Nitrogen-free extract + fibre . .	10.50	»
Starch value	8.30	»

Of the experimental rations the two ryegrasses and the tall fescue were the only ones which supplied amounts of food elements up to KELLNER's standard, and Table IV gives the gain or loss of nitrogen undergone by the animals calculated from the difference between the nitrogen digested from the food and that excreted in the urine, and stated as loss or gain of protein per day and per 1000 kilog. live weight.

TABLE IV. — *Loss* (—) *or gain* (+) *of protein to the animal body in gms. per day and per* 1000 *kilog. of live weight.*

Italian ryegrass:	
Cut young	+ 256
Cut in flower	— 34
English ryegrass:	
Cut young	+ 322
Cut in flower	+ 25
Tall fescue:	
Cut young	+ 153
Cut in flower	+ 74
Cut after flowering	+ 93
Tall oat grass:	
Cut young	— 43
Cut in flower	+ 44
Timothy:	
Cut after flowering	+ 8

The present results would seem contradictory to those obtained by KELLNER, but the discrepancy may be explained by the fact that KELLNER's maintenance rations are not minimum but maximum maintenance rations, *i. e.* that any increase will cause the animal to put on weight, and, consequently, the rations can be reduced within certain limits without causing the animal to actually lose weight.

The digestibility coefficients obtained in the present trials are tabulated in Table V and also stated as percentages of the hay made from young grasses. KELLNER's digestibility coefficients for hay made from grass in flower (Table VI) differ considerably from these results. He places English rye grass below Italian with regard to digestibility, while the order is reversed in the present results. The variation in digestibility makes it difficult to judge of the relative value of the plants on this basis, but the remarkable digestibility of tall fescue may be pointed out. As the time of cutting advances the digestibility decreases, but even in this decrease there is considerable variation with the different species ; with tall oat grass the decrease is small, while with the ryegrasses and the fescue the decrease amounts to 25 per cent., and of the nutrient elements protein suffers the largest proportional loss. Considering both digestibility results and the production per acre, the value of the above grasses as fodder plants may be classed in the following order: 1) tall fescue, 2) English rye grass, 3) Italian rye grass, 4) tall oat grass, and 5) timothy.

Mineral matter. — It is impossible to determine digestibility coefficients for the various mineral elements on account of the large experimental error which would occur due to the interchange of salts in the animal organism ; a balance can only be struck between amounts fed and amounts excreted. This balance showed a considerable loss of lime to the animal body when the ration consisted entirely of grass hay, fescue and timothy causing least loss. The writers analysed the urine for silicic acid and were

TABLE V. — *Digestibility coefficients.*

Kind of hay	Organic matter		Protein				Crude fat		Nitrogen-free extract		Crude fibre	
			Crude		Pure							
	absolute	relative	absolute	relative	absolute	relative	absolute	relative	absolute	relative	absolute	relative
Italian rye grass:												
Cut young	74.2	100	56.4	100.0	51.8	100.0	53.4	100.0	79.1	100.0	73.7	100.0
Cut in flower	58.7	78.7	26.4	46.8	13.5	26.1	36.4	68.1	68.0	86.0	46.2	62.7
English rye grass:												
Cut young	76.0	100.0	62.1	100.0	56.8	100.0	53.1	100.0	80.6	100.0	76.6	100.0
Cut in flower	59.8	78.8	40.9	65.9	26.5	46.2	48.9	92.1	64.7	83.6	55.1	71.9
Tall fescue:												
Cut young	70.7	100.0	63.2	100.0	57.9	100.0	55.9	100.0	75.4	100.0	67.7	100.0
Cut in flower	60.3	85.3	53.6	84.8	46.0	79.6	73.0	130.6	64.3	85.3	53.5	79.0
Cut after flowering	56.7	80.2	51.0	80.7	37.0	64.0	82.6	147.8	62.1	82.4	47.0	69.4
Tall oat grass:												
Cut young	57.8	100.0	46.5	100.0	33.2	100.0	52.3	100.0	54.4	100.0	63.9	100.0
Cut in flower	56.4	97.6	43.7	93.8	33.5	100.0	48.7	93.1	47.5	87.3	66.3	103.7
Timotly:												
Cut after flowering	54.4	—	37.1	—	32.2	—	60.1	—	62.4	—	43.9	—

TABLE VI. — *Kellner's digestibility coefficients.*

Kind of hay	Protein		Fat	Nitrogen free extract	Crude fibre
	crude	pure			
Italian ryegrass	63.4	54.4	43.8	65.5	65.1
English ryegrass	50.0	39.3	29.9	55.1	51.0
Tall fescue	50.0	38.4	29.9	53.7	53.1
Timothy	47.1	41.6	41.7	62.0	53.0

led to believe that the two following causes might account for the observed loss of phosphoric acid and lime :

1. The acidity of the ash of grasses, due more especially to silicic acid, produces an eminently toxic effect ; silicic acid goes into the circulation, where, notwithstanding its weak acid properties, it plays an important part, causing a loss of mineral bases and eventually even of phosphoric acid.

2. The movement of phosphoric acid is regulated by that of the lime with which it is intimately connected. It would therefore appear that the insolubility of the phosphoric acid in the ash of grass is an important factor, making it difficult for the animal to make good the losses which follow as a consequence of the lime drainage caused by the silicic acid.

The mineral matter of a ration composed solely of grass hay should therefore be supplemented. In practice this is usually done by adding to the ration fodders with alkaline ash, such as leguminous fodders or roots, but failing these means, calcium carbonate should be added. The writers carried out some trials in which calcium carbonate was introduced into the ration, and observed that the latter substance in no way diminished the digestibility of the grasses, while it prevented the losses of lime and phosphoric acid to the animal body, so that a small gain was actually recorded.

CONCLUSIONS.

1. The figures given in tables of food values cannot be more than approximately accurate in so far as they deal with hay made from certain grasses.

2. The digestibility of hay decreases with the increase in age of the grasses from which it was made, but the amount of decrease varies considerably with the different species, which may be placed in the following ascending order : tall oat grass, tall fescue, English ryegrass, Italian ryegrass.

3. The food value of various hays differs considerably from that given by KELLNER. Tall fescue heads the list and is followed by the two ryegrasses and tall oat grass.

4. A ration composed solely of hay made from grasses causes losses of phosphoric acid and lime to the animal organism, more especially when

the hay is cut very young. The chief cause for this would appear to be the silicic acid present in the grasses, and possibly also the low solubility of the phosphoric acid.

5. The addition of calcium carbonate to the ration has no effect on its solubility, but reduces the losses of phosphoric acid and lime.

541 – **Bacteriological Research on Ensilaged Forage** (1). — GORINI, C. in *Annuario della Istituzione Agraria Dott. Andrea Ponti*, Vol. II, pp. 165-179. Milan, 1911.

As a result of ten years', investigation on the subject, the writer distinguishes four types of silage :

1. Silage in which butyric acid bacteria predominate.
2. Silage in which lactic acid bacteria predominate.
3. Silage in which putrefying bacteria predominate.
4. Silage comparatively free from bacteria.

The first two may be considered normal types, the remaining two abnormal types of silage. Abnormal silage may be produced either when the temperature of fermentation is too low, which favours the development of putrefying bacteria, or when the temperature is too high, which destroys all bacterial life; consequently the making of successful silage depends chiefly upon the amount of heat produced in the silo, which may be controlled by the packing, and only to a lesser extent upon the moisture content and quality of the forage. The optimum temperature for the silo is 50° C. (122° F.), at which temperature lactic acid bacteria predominate; if the temperature rises to 60° C. (140° F.) the butyric acid flora is especially favoured.

With regard to the question as to whether it is advisable to classify silage as "sweet" and "sour", the writer observes that strictly speaking all silage is more or less acid and that consequently it should all be classified according to the degree and nature of its acidity, though it does not follow that the quality of the silage can always be determined from its degree of acidity : the rule holds good only within certain limits.

Opinions are still divided with regard to the relative value of the two types of silage for food in general, but when fed to dairy cows the writer gives preference to the lactic acid type, as the butyric acid type is liable to taint the milk and butter.

The writer has also carried out some experiments on seeding pure cultures of lactic bacteria into the silos. The experiments are not yet completely finished, but the results obtained up to the present lead to the following conclusions:

1. That the addition of lactic acid bacteria to the silo improves the keeping qualities of the silage.
2. That different lactic acid bacteria act differently upon the silage.
3. That even at a relatively low temperature it is possible to make so-called sweet silage.

(1) Cf. *Ricerche Batteriologiehe sui Foraggi conservati nei Silos*, by the same writer, for the years 1906, 1908, 1909, 1910, 1912. Premiata Tipografia agraria, Milan. (*Ed*).

542 – **Toxic Bran.** — MARCHADIER and GOUJON in *Annales des Falsifications*, Year 7, No. 64, pp. 77-81. Paris, February 1914.

Bran undergoes degenerative changes on storage which may be the cause of serious disturbances when it is fed to animals. In order to find a method of determining whether any given sample of bran be fit for food, the writers carried out the following experiments: 100 tons of fresh bran were put into a heap in November 1912; in the following February the formation of lumps was observed, while in March the temperature had risen considerably and the centre of the heap was carbonized. Samples were drawn 1) from the outside of the heap which was in friable lumps but not discoloured, 2) from a little further in where the lumps were less friable and dun coloured, and 3) from the centre where the bran had become a compact black mass yielding a fracture rather like that of linseed cake made under high pressure, and looking and smelling of roasted chicory. A sample of the same bran kept apart from the heap was also taken, as well as a fresh commercial sample. They were all analysed and yielded the following results.:

	Commercial sample	Bran not put in heap	Bran from the outside of the heap	Bran from lower layers of the heap	Bran from centre of the heap
Moisture	12.7	14.8	13.6	11.6	11.5
Acidity as H_2SO_4 total	0.074	0.172	0.211	0.776	2.062
Acidity as H_2SO_4 fixed	0.074	0.172	0.211	0.578	1.445
Acidity as H_2SO_4 volatile	0.000	0.000	0.000	0.198	0.617
Fat	1.32	1.70	1.10	2.64	4.98
Ash	5.5	5.8	5.9	6.0	6.2
Anaeroxidase	present	present	present	absent	absent
Soluble in cold water	10.65	12.35	4.35	9.80	18.30

The acidity increases as fermentation proceeds, so that at the end of the process the acid content is fifteen times as high as it was originally, and the oxidising enzymes disappear in the later stages of fermentation. The writers suggest that these two factors be taken as a base for determining whether bran be fit for food, classing the bran as follows:

	Acidity
Normal bran	below 0.150
Bran undergoing decomposition, not yet unfit for food but liable to become so very rapidly	0.150 to 0.300
Bran unfit for food	above 0.300

543 – **The Rate of Liberation of Hydrocyanic Acid from Linseed** (1). — COLLINS, S. H. and BLAIR, H. in *The Analyst*, Vol. XXXIX, No. 455, pp. 70-72. London, February 1914.

Linseed was digested with water to which other substances were added experimentally and the resulting hydrocyanic acid, when formed, was removed, by a stream of hydrogen gas, absorbed in weak caustic soda solution and estimated colorimetrically by the prussian blue test. One particular sample of linseed yielded 0.38 mgm. of hydrocyanic acid per gm. of linseed. The velocity of reaction was such that one half of the total amount was yielded in 46 minutes, whereas solutions of hydrocyanic acid in water yielded one half the total amount in 26 minutes, reaching in 3 hours' time from 98 to 99 per cent. of the total amount present. When the linseed was acidified to represent digestive conditions, no hydrocyanic acid was liberated, and similar negative results followed the use of pepsin and rennet in acid solutions. Even hydrochloric acid of $\frac{N}{100}$ strength prevented the enzyme from working, and $\frac{N}{1000}$ strength produced a marked slowing in the rate of liberation of hydrocyanic acid from linseed.

With non-ruminant animals the acidity of the stomach would render the enzyme inactive. In the case of cattle where 2 to 3 lbs of linseed may be fed daily, the writer attributes the usually innocuous effects partly to the influence of other foods in slowing down the action, and partly to the fact that the hydrocyanic acid formed must be largely evaporated into the air during rumination with its attendant continual regurgitation of the food into the mouth. The linseed " mash " fed to calves is a more likely source of danger. Linseed treated with a large volume of boiling water and kept at 100° C. for half an hour produced no hydrocyanic acid gas, but at 60° the evolution of acid was only slightly checked, though almost completely checked at 90° C.; linseed heated dry to 100° C. or ground finely produced an increased amount of hydrocyanic acid. Linseed mash prepared in a lumpy condition generated hydrocyanic acid from these lumps, slowly at first, but rapidly when the lumps were broken up, showing that the enzyme had not been destroyed in the comparatively dry material inside the lumps.

The extractives, such as petrol, ether, chloroform, etc., had no marked effect on the enzyme, so that the removal of oil from the seed in the manufacture of linseed cake by the solvent method, far from producing a safer material, only tends to concentrate both enzyme and glucoside.

544 – **Live Stock in Morocco.** – MONOD, T. in *Revue générale des Sciences pures et appliquées*, Year 25, No. 7, pp. 341-346. Paris, April 15, 1914.

Though Morocco is a country eminently adapted to agriculture and live stock, its production has remained at a low level owing to the defective methods practised by the natives, who make no attempts to save their stock in years of drought. Conditions could be considerably improved by 1) creating food reserves to fall back upon in periods of drought, such as hay, forage crops, irrigated meadows or maize and sorghum silage; and

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(1) See No. 1352, *B.* Dec. 1913. (*Ed.*).

2) tapping springs and building stone drinking troughs to improve the hygienic condition of the present water holes, which are a constant source of disease to stock.

Horses.— The type varies with the soil in the different localities but all are preeminently saddle horses and belong to the Berber type. They are quiet, hardy, mettlesome, but are lacking in breed and shapeliness. Usually they are less well cared for than in Algeria, brood mares being ill fed and generally undersized. Where they receive rather better treatment, such as in the Marrakech district, the superiority of the animals is evident. The introduction of Arab thoroughbreds should prove very beneficial and the work undertaken in this direction by the State studs should give excellent results.

Mules are very popular in Morocco both for agricultur al purposes and as carriage or saddle beasts; they fetch a good price (£24 to £64) and their improvement by means of selection and the use of imported asses should prove remunerative.

Cattle.— A large demand and a low production due to droughts and diseases have combined to raise prices abnormally, *i. e.* to twice their value of two years ago. Numerous breeds exist, all hardy and fattening readily when well fed. Cattle receive no kind of care; they are allowed to breed promiscuously and are kept out without any kind of shelter. Yet it should be possible to obtain both a good milking breed and a good working breed from the native animals.

Sheep. — Sheep number 1 500 000 in Western Morocco and 900 000 in Eastern Morocco in those districts under French influence, and would be liable to vast improvement under a judicious system of br eding and selection.

Pigs belong to the Iberian race and are spreading all over the country as the natives have not the same antipathy for that species of animals as have the Algerians. A good export trade to Europe, where the products find a ready market, may be predicted.

545 – **Live Stock in New Caledonia.** — LAFFORGUE, G. in *La Vie agricole et rurale*, Year 8, No. 7, pp. 175-177. Paris, January 17, 1914.

New Caledonia is situated on the southern limit of the tropical zone and has a remarkably constant climate, with a mean temperature of 68° to 77° F. (minimum 57° F. and maximum 97° F.), rather long droughts and occasionally very wet periods. The soil is only moderately fertile and may be put under coffee, but live stock rearing is the chief resource of the country.

Colonists embarked on cattle rearing from the outset, using as basis animals of the Shorthorn, Hereford, Devon and Aberdeen-Angus breeds. Crosses of Shorthorn-Devons or Shorthorn-Herefords are now commonest, and of these two, the former seems the better adapted to the country. Large herds, up to 1000 head, range freely on the open stations, which may cover an area of 15 000 acres each, in charge of mounted stockmen who are ably seconded by their dogs. Males and females are never separated and breed promiscuously.

In 1908 New Caledonian cattle underwent a serious crisis due to two principal causes: 1) the deterioration of pastures owing to frequent overstocking, which destroys the grasses and gives the weeds a chance of getting a hold; and 2) running males and females together, which results in numbers of the females being called upon to perform maternal duties before maturity, the annual castration of males not required for breeding purposes being an insufficient preventive measure. Better times are dawning, colonists are beginning to co-operate in order to improve the management of live stock, and stations are being reduced in size in order to lead to a more intensive form of agriculture. Such measures should be completed by the erection of a cold, storage factory, which would make the export of meat remunerative, for New Caledonia is too remote from centres of consumption to make the transport of meat in the form of live cattle an economic possibility.

HORSES, ASSES AND MULES

546 – **Short-faced Abyssinian Mules.** — DECHAMBRE, P. in *Bulletin de la Société Nationale d'Acclimatation*, Year 61, No. 5, pp. 129-132. Paris, March 1, 1914.

The writer mentions an abnormal head conformation frequently met with in Abyssinian mules and interesting from its analogy to special conformations in other types of animals. It consists in a considerable depression of the base of the subnasal bones together with an underhung jaw giving the animal a bulldog expression.

Mules possessing this characteristic are in no way inferior to normal animals; they are small, strong and well ribbed up; but, of course, should the abnormality be developed beyond a certain point, both the breathing and the articulation of the jaws are interfered with and the animal suffers. From an enquiry made by Dr. GROSLAMBERT, it would appear that the short-faced mules, or "fongga", are the result of purely accidental variations which are not inherited. Analogous conformations in other types of animals are represented by the bulldog, the "nãtos" or short-faced Chilian cattle, and tumbler pigeons.

CATTLE

547 – **Present State of Milk Record Associations in Austria.** — ROSSMANIT, RITTER VON in *Mitteilungen des Zuchtvereins für das alpine Grauvieh in Steiermark*, Year 2, No. 1, 9 pages, 1914.

Milk recording has only comparatively recently gained a footing in Austria (1), but it has rapidly become important, as may be gathered from the following data.

In East Galicia milk records are registered by the Lemberg Agricultural Society in 140 herds containing 4344 cows. For this object a special office exists, employing thirteen persons besides the director.

In West Galicia two associations were founded in 1904, followed by two more in 1906. At present the number of animals under record is 450, of which 160 belong to small farmers.

In Bohemia regular test milkings have been carried out since 1905

(1) See article: « The Present State of Dairy-Cow Testing », *B.* Oct. and Nov. 1912. (*Ed*).

exclusively by cooperative breeding and economic associations. Up the present 3500 cows on 692 farms have been tested.

Moravia has, at present, two testing associations with 50 membe and 320 cows.

In Upper Austria the Simmentaler Cattle-breeders' Federation Schärding has kept milk records since 1904. Since 1912, 96 breeders wi 888 cows have submitted to the control. From 1904 to 1912 the avera milk yield rose by about 44 gallons per head per annum. In 1910 t Federation of Simmental Breeders at Ried began the work of milk recor ing, and the next year the Montavon breeders followed suit. In t latter federation, 191 members with 2879 cows submit to the control.

In Salzburg, for the last two or three years six cooperative breedi associations with 1675 cows have been keeping milk records.

Extensive test milking is practised in the Tyrol also, but on accou of the communes and farms being so widely scattered in the high mou tains, a good deal is left to the private recording of the farmers.

In Styria, the "First Styrian Milk Control Association" has carrie out regular milking tests since 1904. In that year it numbered 11 me bers with 365 cows, while in 1914 there were 30 members and 1050 cow The contributions for large landowners are 16*s* 8*d* per year and 2*s* 6*d* p cow per year, while peasant owners pay only 10*d* per year per cow. T association has a yearly State subvention, which has grown gradually fro £33 4*s* to £125. The tests are made three times a week, three perso being employed for the purpose.

Besides the above, milking tests have been practised in Styria b the Federation of Murbodner Cattle-breeding Cooperative Associatio since 1910. At present 1632 cows are under control.

548 – **Red Flemish Cattle.** — RAQUET, H. in *Annales de Gembloux*, Year XXIV, No. pp. 81-102. Brussels, February 1, 1914.

The total number of Flemish cattle is estimated at 700 000 head France and 500 000 head in Belgium. In Flanders in 1912, their density w about 1 to 2 ½ acres. As milkers they are almost equal to the Dutch bre when under a favourable system of management: 14 cows on the fa of Mr. Talpe of Hooghlede, West Flanders produced during the sev years 1902-1908 an average annual yield varying from 780 to 1080 gallo with the nature of the season, being highest in the wetter seasons.

At agricultural shows in Belgian Flanders, points are awarded a cording to the following scale:

Cows.

General appearance, frame	20	general conformation 50 points
Dorsal line	10	
Head, horns, breed characteristics, coat colour	10	
Skin	10	
Udder and teats	20	milking qualities 50 points
Milk veins	20	
Escutcheon	10	
	100	

Bulls.

Dorsal line	20
Frame	20
Fore quarters	20
Skin, horns	10
Pedigree, milking characteristics, escutcheon	10
	100

The breed is very adaptable and has been substituted for Swiss and Dutch cattle in the province of Santander (Spain). It has successfully established itself in Argentine, but the Argentine strain, which is the result of crossing the old red-and-white Flemish cattle with Shorthorns, is more like the old Zeeland cattle than the modern Flemish breed. The breed, represented by 52 bulls and 11 heifers from the best Flemish herds, has also been imported into Saô Paulo, Brazil.

The French herd-book was started in 1886 at Bergues, while the Flemish one is of more recent origin and has its headquarters at Roulers in West Flanders. The writer considers that for registration purposes, the breed should be divided into three sections: 1) milking type, red with a black nose, the original type; 2) beef type produced by crossing with the Shorthorns, red with a pink nose; and 3) general purpose type with predominant milking qualities, red and white with a pink nose. He further suggests that the fee for entering should be abolished as an encouragement to breeders.

549 – **Determination of Growth in Grazing Cattle.** — Bruchholz, K. G. in *Deutsche Landwirtschaftliche Tierzucht*, Year 18, No. 16, pp. 185-187. Hanover, April 17, 1914.

The writer divides young cattle into three groups according to the nature of the growth they make while at grass: 1) Those which form chiefly bone and flesh: these eventually grow to big beasts, and when still young give promise of becoming good breeding, milking or fattening stock. 2) Those in which the increase of weight is almost entirely due to fat: they always remain small, and are less valuable than those of the first group. 3) Those which make little increase in fat, bones or flesh: they will always be poor animals.

To find out to which category the young stock at grass belong, it is essential to take body measurements as well as noting the increase in weight. The writer recommends taking only the girth measurement, at the beginning and end of the grazing time, as taking detailed measurements of a large number of animals is very laborious. The value of this method is shown by the accompanying table, in which data are given for eight heifers; these were turned out to grass in May, at eighteen months old, and taken off again in October. Four months after dropping the second calf they were weighed again for comparison wirh the data obtained earlier.

It may be noted that the chief increase of live-weight took place in May and June; four of the heifers showed much less increase in July and August, and three of them a decrease in September. The girth increased much more evenly.

Increase in weight and girth of heifers.

Number of heifer	1	2	3	4	5	6	7	8
Increase in live-weight during grazing period. . lbs.	216	249	129	64	115	164	293	140
Increase in girth during grazing period . . . . . in.	12	10	9 ½	8	7 ¼	3 ½	2 ½	1 ¼
Live-weight 4 months after second calving. . . . lbs.	1 456	1 318	1 397	1 273	1 278	1 154	1 067	1 005

The table shows clearly that the heifers which increased most in girth were the ones which eventually made the heaviest cows, while the increase of live-weight at this period shows no correlation with the live-weight of the mature animals.

550 – **Heredity of Twin Births in Cattle.** — UHLMANN, E. in *Deutsche Landwirtschaftliche Tierzucht*, Year 18, No. 14, pp. 163-164. Hanover, April 3, 1914.

The writer has investigated a herd in which the birth of twin calves has been very frequent. He found two sisters which had borne twins 2 out of 7 and 4 out of 9 times ; the dam of these cows (as well as the two other sisters) never had twins, but the maternal grand-dam once gave birth to twins. Two daughters of the first cow have also given twins (each 1 out of 3 times), while two daughters of the second cow have calved two and four times respectively without producing twins.

The bulls used have been of various strains not known to have a tendency to twin-production.

The evidence seems to point to a twin-producing character being inherited from the grand-dam mentioned.

SHEEP

551 – **Marocco Sheep and their Products.** — *Bulletin économique du Maroc*, Year 1, No. 6, pp. 5-7. Rabat, August 15, 1913.

There are two chief breeds of sheep in Morocco.

1. The *Muluya Basin* breed, found in the high plateaux of Eastern Morocco, has a close fleece very similar to the Merino ; it is hardy and resistant to drought.

2. The *Atlantic* or *Western* breed which is a kind of degenerate merino.

These types vary to a certain extent; in the neighbourhood of Tangiers, some imported Spanish Merinos have improved the local sheep, while in the neighbourhood of Fez two modifications are met with: the *Beni-Hassen* with a long silky fleece. and the *Berber* which is smaller with a heavier, coarser fleece.

The principal sheep-breeding centres are the High Plateaux of Eastern Morocco and the fertile plains of the Atlantic coast, the Rharb district, the district of Beni Hassen, parts of Shawia, and above all the Marakesh district, the annual production being approximately as follows:

Rabat district	100 000
Fez and Sifru district	50 000 to 60 000
Meknes district	20 000 » 25 000
Shawia	50 000 » 60 000
Mazagan and Saffi districts . .	300 000

In the Rabat district, prices range from 12*s* to 17*s* per head. Exports by sea are prohibited; sheep may leave the country by way of Algeria (approximately 200 000 per annum are exported), and are taxed 3*d* per head on passing out at the frontier. Shearing is carried out in spring and the natives take the fleeces to Jewish or European dealers the following winter and receive 1*s* 4*d* to 2*s* per fleece. The wool is graded into three qualities:

1. *Ourdigha* — short and fine, comes from Shawia and Tadla and fetches the highest price.
2. *Aboudia* — medium quality and unwashed, comes from the Rharb district and the Sebu Valley.
3. *Beldia* — low quality, comes from Rabat, Saffi, and Mazagan districts.

Exports are taxed 4*d* a lb. on washed wool and 6 ½*d* a lb. on unwashed wool, the washing having caused the wool to loose 50 to 60 per cent. by weight. Formerly France was the only importing country, but now Germany takes a large part of the wool produced, as is shown by the following table:

Importing country	Value of imported Moroccan waol			
	1909	1910	1911	1912
	£	£	£	£
France	74 250	91 600	106 800	32 740
England	6 000	13 060	5 250	4 290
Germany	26 990	69 630	90 240	32 580

Large quantities of skins are exported. Sheep skins are also largely turned into slippers, which are then exported to Algeria and Egypt.

552 – **Development and Prospects of Sheep Breeding for Wool in German South-West Africa.** (Lecture given by Prof. GOLF at the meeting of the Kolonial Wirtschaftliches Komitee) in *Zeitschrift für Schafzucht*, Part 4, pp. 81-86. Hanover, April 1914.

The breeding of sheep for their wool is destined to become the most important branch of farming for at least one half of the total area of German South-west Africa. The most important area is the whole south of the colony, that is all the country south of a line running eastward from Windhuk. Then in the northern half of the colony there is a western dry part which is bounded on the west by the Namib desert and on the east by a line drawn from Windhuk to the Kunene passing through Waldaw, Omaruru and Franzfontein. To the north and east of this district cattle are more suitable than sheep, as the thorny pastures injure the fleeces.

On April 1, 1912, the number of wool sheep in German South-west Africa was 46 901. The yield of wool is inferior to that of South Africa, which

is 8.8 lbs. of unwashed wool per head; in 1910 the export from German South-west Africa was 186 180 lbs. worth £37 401. If this industry is to develop satisfactorily, the breeding and management must be improved with the introduction of special wool-producing breeds, the aim being the production of wool of the best quality.

As the most suitable sheep the writer recommends Cape Merinos, which might be improved by the introduction of pedigree rams. In the North of the colony the German Tuchwollschaf would probably be suitable for crossing; in the south, however, the German, Australian or African Kammwollschaf would be more advisable for the present.

GOATS

553 – **Present State of Milk Recording for Goats in the German Empire.** — Report made in the autumn of 1913 to the German Agricultural Society, subcommission for milk records for goats, by Dr. MÜLLER of Dortmund; in *Mitteilungen der Deutschen Landwirtschafts-Gesellschaft*, Year 29, Part 9, pp. 138-140. Berlin, February 28, 1914.

The German Agricultural Association (D.L.G), in the summer of 1912, addressed an enquiry to all the central agricultural offces (landwirtschaftliche Zentralstellen) on the present situation and development of milk recording for goats, and received the following information.

Milk records are kept at present in the Grand Duchy of Hesse, in Hesse-Nassau (district of Wiesbaden), in the province of Saxony, in the Rhine province, in Westphalia, Hanover, Brunswick, Coburg and Sachsen-Altenburg, and in the Kingdoms of Württemberg and Saxony. In several localities, as in Silesia, Oldenburg, Baden, Bavaria and Lippe, the record of performances has been begun, but up to the present there are no complete yearly records available. The milking tests, which yield more or less useful figures, are about 500, and refer to the most different breeds of goats. The first tests appear to have been made in the Grand Duchy of Hesse and in the Kingdom of Saxony about the end of the last century. Recently, thanks to the increasing recognition of the importance of milk recording work, it has been receiving considerable financial aid from the numerous agricultural central offices. Special instructions on the method of carrying out these milking tests are at present published only in Württemberg and Hanover, though short directions are to be found almost everywhere.

The best results have been obtained in those localities in which a special control assistant was available (Westphalia), or in those in which some organization took an interest in milk control.

Most of the observations, especially of late years, are no longer made by measure, but by weight, and if possible every fortnight. In only a few localities are records kept of the weight, age and mating of the animals and of the number and weight of the kids dropped. Data on the height and girth, and on the feeding and utilization of the food, are nowhere to be found. On the other hand in some places the net returns have been calculated. The results vary between — 5*s* 9*d* and + £ 7 10 *s* per animal per year.

The results hitherto obtained are insufficient for the clearing up of several questions connected with the keeping of goats, to a great extent

ecause they have been obtained by different methods. It is therefore ghly desirable that in future uniform methods be adopted.

4 – **The Olfactory Sense of the Honey Bee.** — Mc Indoo, N. E. (Bureau of Entomology, U. S. Dep. of Agriculture, Washington, D. C.) in *The Journal of Experimental Zoology*, Vol. XVI, No. 3, pp. 265-345. Philadelphia, Pa., April 5, 1914.

Olfactory pores were found on the bases of the wings, and on the ochanter, legs, and sting. They numbered approximately 2600 in the rones, 2200 in the workers, and 1800 in the queen. They are described detail.

5 – **Silkworm Rearing in Madagascar** (1). – 1. Fauchère, A. in *L'Agriculture Pratique des Pays Chauds*, Year 14, Nos. 130-132, pp. 12-23, 92-102, 140-147. Paris, January to March, 1914. — 2. *Journal d'Agriculture Tropicale*, Year 14, No., 153, pp. 89-91. Paris, March 31, 1914. BEES

A full account is given of the treatment of silkworms in Madagascar; ie Centre is the most favourable part for *Bombyx mori*, called "landikely". The native worm is *Borocera madagascariensis*, known as "landibe"; iis is reared in the open, either in natural forests of "tapia" (*Uapaca usiacea*) in the Centre and "afiafy" on the coasts, or in plantations of tsitovina" (*Dodonea madagascariensis*) and *Cajanus indicus*. There are two roods in the season; the cocoons are grey and cannot be reeled: they are nerefore carded and spun. This silk gives rise to a considerable trade in ie island.

6 – **Silkworm Rearing in the Yalong Valley, China.** — Legendre, A. F., in *Annales de l'Ecole Nationale d'Agriculture de Montpellier*, Vol. XIII, Parts I-III. Montpellier, July and October 1913, and January 1914. SILKWORMS

The rearing of silkworms in China has been very little improved since arly times, and it would probably be possible to double the yield at very ttle expense. The writer has studied silkworm rearing at a village near ie Yalong river in Szechuan; it varies little throughout the Empire, unless ubject to European influence, as at Canton and Shanghai.

In spite of the height (6000 to 7000 ft.), the eggs begin to hatch at the nd of February or in early March; hatching is sometimes hastened by eeping the eggs in a warm room; it lasts three or four days.

Little attention is given to the worms; they are kept on heaps of aves of mulberry (*Morus alba*) or "ta tchou" (*Cudrania triloba*), in askets or on coarse bamboo mats; these are kept in the roof, and often oove the kitchen, as the smoke from the green firewood is supposed to eep away insects.

The worms of the Kienchang district (Szechuan) moult three times: ch stage lasts about 13 days, and spinning up takes another 10 days, that the whole rearing period is 49 days. For the first two stages only *udrania* leaves are used; they are fed cut up small in the first stage, in rge pieces or whole in the second. The leaves are picked once a day, as on as the dew is off, and the number of meals is increased from four to

(1) See No. 967, *B.* Aug. 1913.

eight as the worms grow; in rainy weather they are not fed. It is suppo that leaves covered by the fine sand occasionally brought by the wind fatal. The old leaves are not removed till there is a considerable accu lation of them, when the worms are picked off into baskets and then back onto the fresh leaves.

The chief errors in the Chinese method are crowding together of worms and not cleaning out often enough; for these reasons the worms liable to disease. The only remedy known is to pick out the diseased or which can be done only imperfectly owing to the size of the mats.

For spinning up, dry rape stalks or oak twigs with the dead leaves are used. Seven days after the cocoons are finished they are placed the sun to kill the larvae, or in dull weather they are put in an oven.

The moths emerge from the cocoons kept for egg production 12 to days after the beginning of spinning; a number of females are made to on each of the egg papers used: these measure about 17 by 11 inches.

Cocoons. — The cocoons are divided into six groups according to sha and quality. In a normal rearing there are 15 to 20 per cent. of the fi quality and 35 to 40 per cent. of the next two, some 35 per cent. bei inferior and 10 per cent. double.

About 33 fresh or 43 dry cocoons go to a Chinese ounce (37 gms.). T yield of raw silk does not exceed 9 per cent. of the weight of the fre cocoons and 7 ½ per cent. is a good average; in bad years it may be or 4 to 4 ½ per cent.

The cocoons are of four chief colours: pure white, canary yello golden and green. The raw silk is dull and dirty-looking.

The yield from 25 gms. of eggs may be 23 kg. in a good year, and 18 kg. in ordinary seasons, while in France 60 kg. is often obtained.

Breeds. — Four breeds are known, all being single-brooded and wi eggs in clusters:

1. *Pé-ts'an* (uncoloured); two varieties, one with white legs (giving white cocoo and the other with yellow legs.
2. *Houa ts'an* (speckled); each segment with a grey band posteriorly; legs yell
3. *Lao hou ts'an* (striped green); uniform dark brown, with pale yellow velv legs; head striped with black; cocoon very full, but often green and theref not liked.
4. *Ou ts'an;* less dark than the preceding, with the same striped head; prol yellow.

There is also a wild silkworm ("ié ts'an"), much like the "lao hou ts'an living on mulberry.

Diseases.—"Pébrine" occurs occasionally in a mild form, and is su posed never to occur with "flacherie"; the latter breaks out every thr or four years and carries off 90 per cent. of the worms. "Muscardine takes about 1 per cent. of the worms, and "grasserie" (which preven their spinning) about 10 per cent. A good many of the worms pupa without spinning.

Bajac's three-furrow Flemish plough with counterweight.

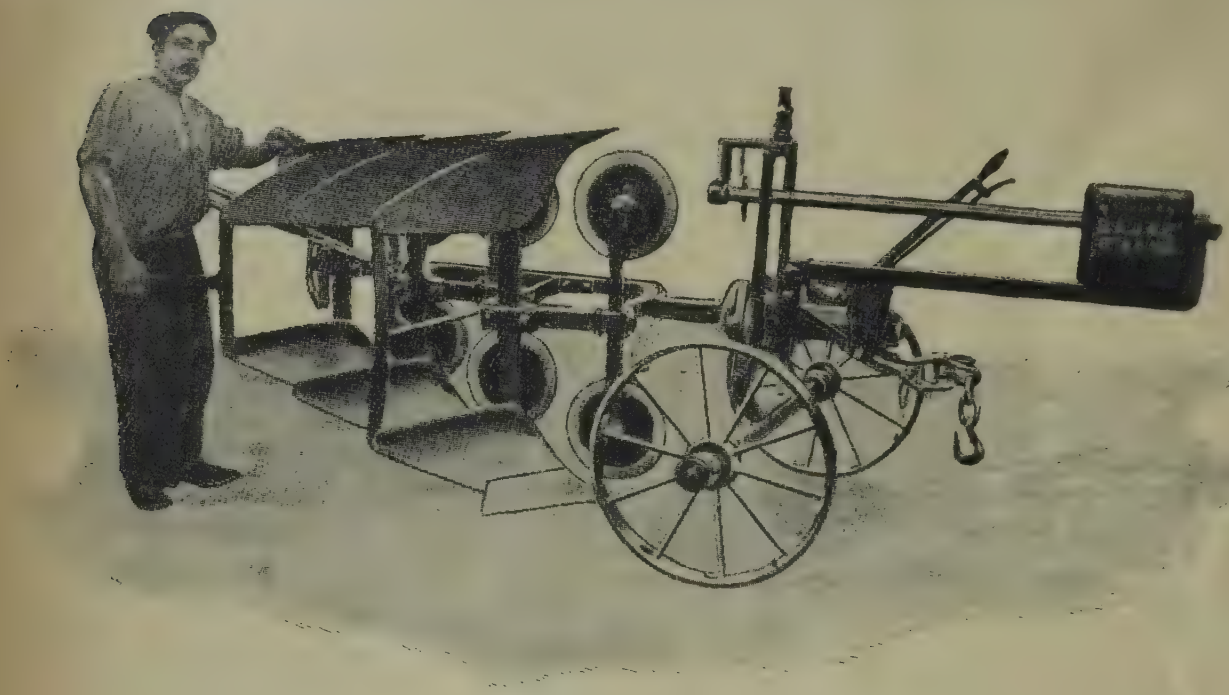


Fig. 1.
Position for turning.

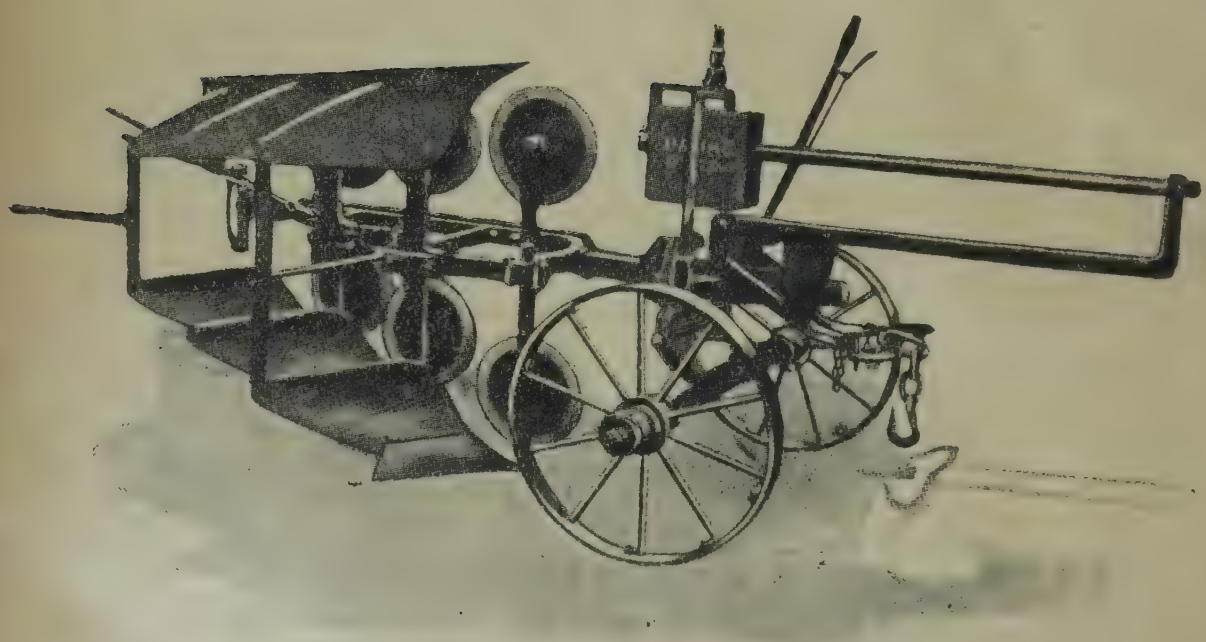


Fig. 2.
Position for working.

One of the worst enemies is a fly, which oviposits in the larvae ; its spread is encouraged by the practice of leaving the dead worms about instead of burning them.

Mulberries. — There are four varieties : *a*) with dentate leaves ; *b*) with deeply divided leaves, not so well liked by the worms ; *c*) with leaves pubescent along the veins, and *d*) the wild mulberry with pubescent leaves refused by the domestic silkworms. A trunk-rot is about the only disease seen.

FARM ENGINEERING.

557 - **Machines at the General Agricultural Show, Paris, 1914.** — RINGELMANN, MAX in *Journal d'Agriculture Pratique*, Year 78, Vol. I, Nos. 11, 12, 13, 14, pp. 341-344, 371-373, 399-402, 438-439. Paris, March 12, 19, 26 and April 2, 1914.

AGRICULTURAL MACHINERY AND IMPLEMENTS

This year the number of exhibitors was 619 as against 665 in 1913, The importance of the show, however, was not lessened and bore witness to the constant improvement in the construction of agricultural machines and implements. In this paper detailed descriptions and figures of several of the exhibits are given.

I. *Apparatus for the mechanical tillage of the soil.* — This class was represented by a large number of machines, including almost all those which took part in the Grignon and Trappes trials of last autumn. Among the tractors, windlass and hauling tractors, motor ploughs and rotary diggers, steam lorries and steam and petrol traction engines, the most noteworthy were the exhibits of the following firms : Compagnie internationale des machines agricoles de France, Bajac, G. Filtz, Stock, Bauche, Lefebvre, Doizy, Société de la Motoculture Française, Tourand and Derguesse, Foden, Société française de materiel agricole of Vierzon, Pécard frères, Lanz, de Mesmay, Case Co., Pavesi and Tolotti, Dion-Bouton, Lefébure, Landrin, and Amiot.

In the latest type of the DE MESMAY tractor, all four wheels are driving wheels, the object of this being to diminish the compression of the soil. Its width is only 50 inches so that it can be used in vineyards. It weighs empty about 3080 lbs. One of these machines (15 HP) took part in the international competition at Chassart in September 1913, when, according to the general report, it ploughed 6.92 acres to a depth of 6.3 inches in 15 hours 57 minutes, the work being excellent.

The CASE tractor (40 HP) weighs 7.26 tons when in working order; at Chassart it hauled a 6-furrow gang plough and ploughed 23.34 acres to a depth of 6.5 inches in 16 hours 4 minutes. It worked very regularly, never stopping for more than a few minutes to lubricate.

The LEFÉBURE windlass consists of a four-wheeled chariot bearing a vertical Abeille engine (12-15 or 20-25 HP), which drives a windlass mounted on a horizontal axis at right angles to the axles of the wheels. In ploughing, two of these machines are used as on the usual double-engine system. Each windlass weighs empty 5500 to 5900 lbs.

The LANDRIN windlass tractor carries a 45 HP engine and weighs about 5.4 tons ; it can travel at four different speeds, from 1.86 to 7.45 miles per hour. The driving wheels are provided with twelve adjustable cleats which can project up to 4.8 inches. The motor by itself proceeds rapidly, then stops, anchors itself and hauls in the cable also at four different speeds, from 0.9 to 3.7 miles per hour. It can wind up to 500 feet of cable.

AMIOT's motor plough with a 40 HP Abeille engine is mounted on a four-wheeled frame. The driving wheels are provided with oblique projecting cleats which are removed when travelling on roads. The plough is situated behind the motor ; it is a double three-furrow Flemish gang plough, which can be lifted by a kind of crane worked by the motor itself ; thus one man can drive and work the whole machine from his seat.

PAVESI AND TOLOTTI's motor plough consists of a triangular frame on three wheels, the front one being the steering wheel and the near hind one the driving wheel. The latter is provided with blades which project vertically from the lower part of the tire only, and are worked by a special excentric. The ploughs, from one to six in number, are placed at the side of the frame between the steering and driving wheels, so that the plough beam is pushed instead of being hauled. One man seated about the middle of the frame is sufficient to drive the machine. It is built in two sizes, 16 to 20 HP and 40 to 50 HP.

Among the ploughs exhibited in Paris, an improvement deserves to be specially mentioned, *viz.* A. BAJAC's movable equilibrium counterweight. As is well known, it is extremely fatiguing for the ploughman, when using the heavy two or three-furrow double Flemish ploughs, to turn them round at the end of the furrow, or to move them on a road or headland. In order to obviate this drawback BAJAC fit a sliding cast iron weight (176 lbs.) on to a horizontal hollow bar attached to the fore part of the plough (see figs. 1 and 2). The weight can be retained at the extremity of the bar by means of a pin. When the weight is behind the axle of the fore-carriage it increases the weight of the plough and presses it into the ground, while, when pushed to the extreme end of the bar, it counterbalances the weight of the plough and allows the latter to be easily handled. This principle has been applied by BAJAC in several different forms; in the case of the largest ploughs the counterweight and fittings weigh as much as 440 lbs. and the weight is shifted by a small winch.

Sowing machines and drills.— Of the numerous drills, that exhibited by O. JOERISSEN is a force feed with an obliquely fluted feed shell, varying in size according to the nature of the seed. The quantity drilled is regulated by the speed of the feeding shaft ; the gearing is enclosed in a casing and may be adapted to 16 different speeds.

In the « Baby » drill the fluting is double and parallel to the axle.

In LAVAULT's drills the feed consists of a series of claws acting alternately and varying in size according to the nature of the seed.

In CHARLIER FRÈRES's drills the shoe furrow openers are replaced by two disks set at an acute angle to each other.

Potato planters are represented by the MOLINE machines and by those of FASCIAUX ; in the latter a boy seated on the planter throws the seed potatoes into holes made in the ground by blades mounted on a disk revolving at right angles to the axle of the wheels ; by changing the gears the holes in the rows may be made at 18,20 or 22 in. apart.

Sprayers and sulphurers. — Various models were exhibited by a number of makers, among whom V. VERMOREL showed a very complete collection.

BERGÈS BACHASSE AND CO. showed a pack-saddle sprayer in which the two cylindrical reservoirs are fitted with a device to diminish or prevent the wave motion of the liquid in them which is so trying to the animal. It consists of a series of slotted felt disks arranged parallel to the ends of the reservoirs.

MIRANDE FRÈRES' sprayer is mounted on two wheels ; equilibrium is maintained by special harness and the whole can pass between rows of vines only 3 ft. 3 in. apart.

Harvesting machines. — S. PLISSONNIER exhibited a motor mower on Valloton's system ; it is on three wheels with a 6 to 8 HP engine ; it weighs about 1980 lbs. and cuts 3 ft 3 in. to 6 ft 6 in. according to the kind of crop and the slope of the field.

The SOCIETÉ LA FRANCE exhibited a motor reaper and binder. It carries a smale 3 ½ HP engine which drives the reaping and binding apparatus, while the team only draws the machine. Somewhat similar machines are shown also by some American firms, in which the engine is partly supported by a small wheel.

GARNIER AND CO. exhibit a horse rake with several improvements, among which is one to deaden the shock of the teeth.

Among the reapers and binders A. RIVET presented one in which the reel slats instead of being placed in planes parallel to their axis of rotation are disposed helically so as to throw the grain obliquely on the platform canvas; the binding is improved by this means, especially in the case of short straw.

G. RICHOMME exhibited a combined binder and thresher which on the whole resembles a common binder, but the elevator is replaced by three successive threshing devices through which the cereal ascends ; the straw then passes onto the binder deck and the grain is elevated by a belt and poured into sacks.

There were several POTATO DIGGERS and BEET ROOT LIFTERS, among the latter one built by GUICHARD & FILS provided with an elevator that loads the beets into a cart.

Motors.— A number of internal combustion motors were exhibited, some burning paraffin, others heavy oil, naphthaline and producer gas ; among these DUBOIS' two stroke motor is noteworthy for the distribution which is effected, not by valves, but by the displacement of the piston which uncovers alternately the opening for the escape and that for the admission of compressed air into the case.

Machines for the preparation of agricultural produce for market. — Several threshing machines were exhibited, each of them presenting some improved detail. There were fans and straw elevators forming part of, or working with. threshing machines or straw balers. Among the latter LEFEBVRE-ALBARET exhibited a baler which turns out bales weighing 77 to 88 lbs., and which is arranged so as to make small bales also, not exceeding 22 to 33 lbs.; and the COMPAGNIE INTERNATIONALE DES MACHINES AGRICOLES DE FRANCE exhibited a portable baler with a rapid stroke of the piston and carrying a 4 HP horizontal engine on its fore-carriage.

G. BARRAULT exhibited a pulp and straw mixer for the thorough mixing of small straw and beet pulp.

SIMON FRÈRES had a motor apple-crusher, being a combination of a small engine and a crusher on the same small chariot.

For wine making there were several labour-saving machines : MABILLE FRÈRES' *foulo-pompe* crushes the grapes and elevates them by means of a screw working in a horizontal cylinder, which, after crushing them, forces them up a vertical or inclined pipe. One of these machines driven by a 3 HP motor could crush and raise to a height of 50 feet from 12 to 15 tons of crushed grapes per hour.

Always with a view to saving manual labour many large hydraulic and motor wine presses have been built and exhibited. In MARMONIER ET MABILE'S presses the hydraulic pumps are driven continuously by a motor and a special device prevents the pressure exceeding a certain fixed limit.

In MARMONIER'S vertical pump a rapid displacement of 2.4 to 2.8 in. per minute can be obtained at first, which grows slower as the pressure increases. In MABILLE'S pump the pressure automatically rises again as soon as it has sunk owing to the flow of a certain quantity of must.

Other machines and implements. — Among pumps one exhibited by C. DUQUENNE for deep wells or borings is distinguished by a descending column of water under pressure playing the part of piston to an apparatus situated at the bottom of the well called an aspirator. GIGON exhibited an apparatus, connected with a small clock, which, on being set, will automatically discharge into a manger a previously prepared ration of fodder when the given hour is reached.

558 – **Motor Ploughing Competition of the North Kent Agricultural Association.** — *The Implement and Machinery Review*, Vol. XXXIX, No. 464, pp. 1089-1092. London, December 1, 1913.

On November 5, 1913, a motor ploughing competition was held by the North Kent Agricultural Association at Farningham, at which the following four machines competed, the prize offered being a gold medal;

Saunderson's « Universal » Model G, 18 to 20 H. P. agricultural motor and a Howard 3-furrow B. Z. plough,

The Ideal Agricultural Motors Co's « Ideal » agricultural motor and a Howard 4 furrow plough.

The « Stock » self-contained 6-furrow motor plough.

The « Ivel » old pattern 20 H. P. agricultural motor with a Cockshutt « Kid Kangaroo » 3-furrow plough.

To each machine a portion of land in the same field was allotted. The land was substantially of identical character throughout the four portions. The depth of the ploughing was in all cases approximately 7 inches and the quality of the work was fair. The consumption of fuel after running two hours was measured.

In making their award the judges made the question of first cost and economy of working an important factor. The other points on which the judging was based were: Acreage ploughed in a given time, quality and depth of work, weight on the land, fuel and oil consumption, ease of transport, simplicity of design and strength, accessibility and facility of repair, adaptability to other farm uses and ease of handling. For each point marks were awarded on a variable scale according to its relative importance. Full consideration was also given to interest on capital, depreciation, maintenance and repairs. In the results the points awarded were as follows:

« Universal »	357	« Stock »	276
« Ideal »	294	« Ivel »	158

The following table gives the principal results obtained at the trial:

	« Universal »	« Ideal »	« Stock »	« Ivel »
Price . . .	£ 267	£ 650	£ 1 050	£ 365
Acres ploughed in 2 hours. .	1	1	2 ¼	¾
Fuel consumed . . paraffin.	44 pints	—	—	36 pints
Fuel consumed . . petrol. .	2 »	52 pints	—	5 »
Fuel consumed . . benzol .	—	—	68 pints	—
Cost per day	£ 1 18*s* 0*d*	£ 2 12*s* 0*d*	£ 5 6*s* 4*d*	£ 2 0*s* 8*d*
Cost per acre.	4*s* 9*d*	6*s* 6*d*	5*s* 10*d*	7*s* 8*d*

559 – **New Hand Drills** (1). — Von Rümker in *Deutsche Landwirtschaftliche Presse*, Year XXXXI, No. 33, p. 409 + 1 fig. Berlin, April 25, 1914.

The writer points out the advantages of two hand drills (for one and two rows) and one machine for sowing single grains in holes, built by him and by H. Leidner.

The advantages of the drills consist in their continuous work, in their easy management and their suitableness for all seeds and methods of sowing. They allow a very uniform distribution of seed, even with small quantities per unit of surface ; they do not crush or otherwise injure the seed and they can be instantly emptied by tilting over. The two-

(1) See: No. 1207, *B.* Aug. 1912. (*Ed.*).

row machine allows of the rows being from 3 ¼ to 16 inches apart and it is so constructed that the seed can flow into only one funnel if so required. The field to be sown does not require any other preparation than that which is usual for team-hauled drills, nor is any harrowing required after drilling.

The marker is especially suitable where grains have to be sown singly. With three or four assistants upwards of 50 000 seeds can be sown per day.

These machines will be found especially useful in plant-breeding establishments, in gardening and forestry, and in scientific institutions where varieties are tested, and in general in all cases in which continuous and perfect seeding is required. The prices of the machines are the following: - One-row drill £5 8*s*, the two-row drill £7 7*s*, and the marker or single-grain seeder £9 16*s*.

560 – **Fletcher and Becker's Fruit Grader.** — *The Implement and Machinery Review*, Vol. XXXIX, No. 464, p. 1072. London, December 1, 1913.

The grading of fruits by machinery ensures a more rapid and uniform separation than when this work is done by hand, but some machine graders are liable to damage delicate fruit. With this new grader (see fig. 3, facing p. 808), however, bruising seems to be impossible. Apples, tomatoes, gooseberries and similar fruit can be separated into four grades at the rate of two bushels a minute and cleaned at the same time.

Each grading surface is composed of indiarubber belting, in which suitable sized holes are punched, laced round two rollers, and three such units at varying heights form the bottom of the main trough of the machine. Any of these belts can be quickly removed and replaced by others having smaller or larger holes. The rollers carrying the belts are driven by chain and sprocket gearing actuated by the operator, who stands at the hopper end of the machine.

The fruit as it is carried along by each belt comes into contact with suspended cleaning brushes, which also help the separation, the smallest size falling upon the first packing table and the largest passing out at the far end of the machine.

The packing tables are made of canvas and held in strong wooden framing; their height may be easily regulated.

561 – **"Germania" Potato Esicator with Oil Heating.** — *Maschinen-Zeitung*, Year 12, No. 4, p. 45. Berlin, February 15, 1914.

The Association of German Potato Dryers recently tested the two-cylinder potato esiccator "Germania" at the potato flake factory at Löbnitz near Cöthen. According to Prof. Parow's report the trial was very satisfactory.

The special character of this esiccator is that the cylinders are not heated by steam but by oil at a temperature of 250° C. (482° F.), heated in a special boiler, and then pumped into the cylinders. The work is quite free from danger, as the ignition point of the oil is 340° C. (734° F.) and neither the boiler nor the pipes have to bear any pressure. The return of the oil to the boiler is also very simple.

The whole plant, without woodwork and masonry, costs about £800. About £40 worth of oil is required.

562 – **The Manufacture of Agricultural Machines and Implements in Russia in 1911.** — *Landwirtschaftliche Maschinen u. Geräte*, Year 14, No. 13, pp. 15-22 and 40. Artern, Prov. of Saxony, March 28, 1914.

In 1912 the statistical division of the Bureau for Agricultural Machinery at St. Petersburg, considering it necessary to know the present state of the manufacture of agricultural machines and implements in Russia, collected material by enquiries addresed to manufacturers, to factory and Inland Revenue inspectors, to the Customs Department and to others, and has now published a book on the subject under the title: "The manufacture of agricultural machines and implements in 1911 and their importation into Russia.".

In spite of the great competition of foreign countries, the machine industry has developed of late years to such an extent that in 1911 it was in a position to place on the home market £6 502 400 worth of machines and implements, the output of factories, small workshops and private artisans being included in this sum. According to the enquiry, about 820 factories build agricultural machinery ; of these 665 are situated in European Russia, 110 in Poland, 37 in the Caucasus and 8 in Siberia. Their total output amounted in 1911 to £5 320 017. Table I shows the number of factories and the value of the machines built by them.

From this table it will be seen that the agricultural machine industry is most developed in South Russia, in the so-called New Russia and in the Northern regions. This is due, on the one hand, to the facilities for providing the raw material, iron and steel, and on the other to the demand for improved equipment in those districts.

The above sum of £5320 017 is distributed among the various groups of machines as follows:

TABLE II.

	£
Tillage implements	954 530
Sowing machines	804 500
Harvesting machines	1 312 321
Threshing machines	713 360
Cleaning and grading machines	239 796
Machines for preparing fodder	146 225
Gins and transmissions	298 053
Power motors	324 062
Other machines and implements and duplicate parts	527 170
	£5 320 017

Among the tillage implements, ploughs represent, about three-fourths of the total value. They are built in almost every "government", but especially in Southern Russia, where they were already manufactured on a large scale in the seventies of last century. The total number of ploughs built in Russia in 1911 may be set down at 650 000. The exact number and value of machines and implements constructed by private artisans

TABLE I.

Territories and "governments"	Number of works	Value of otuput £
Central agricultural territory: Kursk, Orel, Rjasan, Tambov, Tula, Voronesh	73	341 825
Middle Volga: Saratov, Simbirsk, Pensa, Nijni-Novgorod, Kasan, Ufa	63	169 168
Lower Volga: Samara, Orenburg, Astrakhan	9	19 243
New Russia: Bessarabia, Kherson, Taurida, Yekaterinoslav, Don province	157	2 876 913
South west: Kiev, Podolia, Volhynia	68	170 860
Little Russia: Kharkov, Poltava, Chernigov	40	436 242
Industrial district: Vladimir, Moscow, Kaluga, Tver, Yaroslav, Kostroma	48	328 715
White Russia: Minsk, Moghilev, Vitebsk, Smolensk	47	47 050
Lithuania: Vilna, Kovno, Grodno	11	48 953
Lake district: Pskow, St Petersburg, Novgorod, Olonets	9	10 573
Baltic provinces: Livonia, Courland, Esthonia	39	286 634
Urals: Vyatka, Perm	100	94 945
North: Vologda, Arkhangelsk	1	—
In 50 governments of European Russia	665	4 831 121
Poland: Warsaw, Kalisz, Kielce, Lomza, Lublin, Pietrkow, Plock, Radom, Siedlce, Suwalki	110	437 088
Caucasus: Kuban, Stavropol, Terek, Tiflis, Erivan	37	43 455
Siberia: Tobolsk, Tomsk, Amur prov., Lake district	8	8 353
The whole of Russia	820	5 320 017

cannot be easily determined; still, from enquiries made, their value may be estimated at about £740 000. Besides this, a number of factories

and workshops mount and repair agricultural machines, for, which they also make a certain number of duplicate parts. The value of this kind of work may be estimated at about £444 066.

The grand total of the output of the Russian factories and workshops is therefore about £6 502 400. But this is insufficient to meet the demands of the Russian farmers, who still import large quantities of agricultural machinery from abroad. According to the Customs returns in 1911 about £6 119 124 worth of foreign machines and implements were imported and in 1912 about £6 540 881. Among the imports of 1911, reapers, hay tedders and horse rakes figure for £2 524 621, threshing machines for £610 907 and scythes, sickles and forks for £264 325.

The consumption of agricultural machines has risen during the last 30 to 35 years from £845 840 to £12 581 870. In order to promote still further the use of good agricultural machines and implements, about two years ago the Russian Ministry of Agriculture set aside an area of 294 acres, near the agricultural school of Eugenfeld, for the establishment of a permament station for testing such machines. They are selected for trial by a special Bureau in St. Petersburg, which applies directly to foreign firms whose machines it wishes to test and informs them of the condition of the trials. This season most of the tests will deal with tillage machines: tractors, steam ploughs, etc.

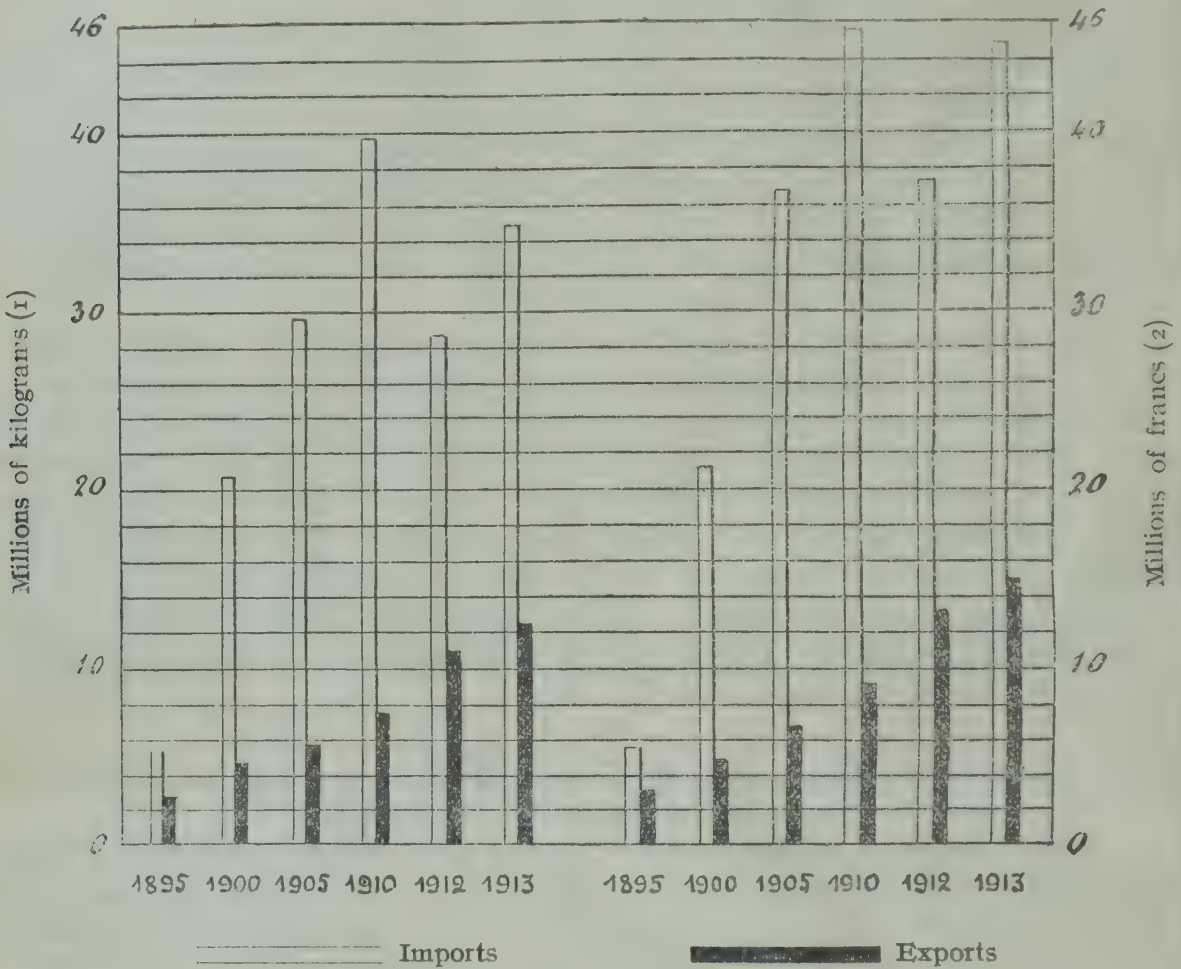
563 – **The Trade in Agricultural Machines in France.** — COUPAN, G. in *La Vie Agricole et Rurale*, Year 3, No. 18, p. 469. Paris, April 4, 1914.

There being no available statistics as to the quantities of agricultural machines and implements made in France, an idea of the development of this industry can only be formed from the statistics of the imports and exports. The annexed diagram shows the rapid increase of the imports since 1895 and the slow rise of the exports.

By far the greatest quantity of agricultural machines and implements imported into France come from the United States, namely from 55 per cent. in 1895 to 69 per cent. in 1912. The next most important country in this connection is the United Kingdom (37 per cent. in 1895 to 10 per cent. in 1912) followed by Germany, from 5 per cent. in 1895 to 10.5 per cent. in 1912.) As for the kinds of machine imported, mowers, reapers and binders occupy the first place. During the first 10 months of 1912 and of 1913 they amounted to about 70 per cent. of the total imports.

French machines are exported to many countries, chiefly however to the French colonies and protectorates.

French imports and exports of agricultural implements.



(1) 1 million kilos = 2 204 620 lbs.
(2) 1 million francs = £39 648 16*s* 8*d*.

564 – **Imports and Exports of Agricultural Machines and Implements into and out of Germany in 1913.** — *Maschinen-Zeitung*, Year 12, No. 4, p. 42. Berlin, February 15, 1914.

The following table shows the numbers and value of the most important agricultural machines imported into and exported from Germany during the year 1913:

	Imports		Exports	
	No.	Value £	No.	Value £
Threshing machines	526	—	20 189	441 176
Iron ploughs	5 362	—	292 610	653 593
Ploughs for power motors	268	—	326	—
Mowers and reapers	50 638	1 176 468	6 508	—
Milk separators	33 055	133 803	45 892	196 078
Machines for breweries, distilleries, and sugar, lime, clay and cement factories	—	24 510	—	1 862 741
Other agricultural machines	—	133 803	—	1 568 624

565 – Review of Patents

Tillage machines and implements.

Austria,	64 488. Toothed wheel gear for internal combustion ploughing machine.
	64 489. Spur wheel for steam plough traction engines, motor ploughs and the like.
	64 821. Hoeing apparatus.
Belgium,	262 502. Plough mouldboard with rollers and conveyers.
France,	464 667. One-way plough with metal beam.
	456 191. Motor plough.
	464 058. Motor tractor plough.
	464 232. Attachment for motor ploughs and the like.
	463 000. Double gang plough in which the turning, fixing and adjusting is done automatically by the team.
	463 001. Motor plough.
Germany,	272 006. Apparatus for driving agricultural machines by electric power.
	272 050. Hoe for agricultural motors.
	272 204. Driving wheel for motor ploughs in which skidding is prevented by radially moveable spuds worked by an excentric.
	272 538. Hoeing machine.
	272 539. Hand tilling implement.
	272 540. Device for simultaneous and uniform raising and lowering of plough shares in motor ploughs with revolving beam.
Hungary,	61 852. Plough drawn by electric power.
	61 947. Tilling machine.
	62 053. Motor ploughing apparatus.
	62 192. Hoeing machine.
Italy,	130 979. Ploughimg machine.
	132 899. Improvement in harrows.
	134 585. Improved coulter for ploughs.
	135 964. New non-skidding wheel for ploughing and other agricultural machines.
	137 552. Cultivator.
Switzerland,	63 482. Device for adjusting the gage of plough wheels while working.
	63 484. Tilling implement.
	63 761. Apparatus for machine tilling.
	63 762. Tilling machine with motor driven implement shaft.
United Kingdom,	26 343. Flexible arms for agricultural implements.
	26 500. Ploughs.
	26 593. Cultivating apparatus.
United States,	1 087 620. Motor driven device for tilling the soil.
	1 088 788. Folding harrow.
	1 089 072. Disk furrow opener.
	1 089 325. Soil pulverizer.
	1 089 351. Automatic hoe.

Manure distributors.

France,	463 128. Spreading device for manure distributor.
Germany,	272 051. Manure distributor with roller.
Hungary,	62 014. Manure spreader.
United Kingdom,	25 773. Manure and seed drills.
United States,	1 090 293. Fertilizer distributor.
	1 090 356. Fertilizer distributor.

Drills and sowing machines.

Austria,	65 008. Furrow opener for drills.
France,	462 978. Machine for making holes in the ground in which to plant potatoes.
	464 584. Portable sowing apparatus.
Hungary,	61 803. Potato planting machine.
	61 937. Drill and manure spreader.
Italy,	136 008. Rotary sowing machine.
	138 540. Apparatus on wheels for thick sowing.
Switzerland,	63 485. Sowing and manure spreading machine.
United Kingdom,	25 700. Seed drills.
United States,	1 087 211. Combined seed planter and manure distributor.
	1 087 319. Seeder and cultivator tooth.
	1 089 458. Corn planter.
	1 089 893. Corn planter attachment.

Reapers, mowers, etc.

Austria,	64 620. Motor mower.
France,	463 666. Side delivery rake.
	463 624. Lawn mower.
	463 805. Motor chassis for mowers, reapers and binders of all systems.
	463 398. Mowers with fore-carriage.
	464 454. Improvements in side-delivery rakes.
Hungary,	61 872. Hand reaper.
Italy,	134 347. Sheaf opener.
	134 603. Motor mower.
	135 120. Mower, reaper and motor car with reversible motion.
United States,	1 087 455. Corn harvester.
	1 090 029. Attachment for binders.
	1 090 246. Motor harvester.
	1 090 371. Corn gatherer and husker.
	1 090 747. Tobacco harvester.

Machines for lifting root crops.

Belgium,	262 745. Improvements in topping and lifting machines for beet and other roots planted in rows.
France,	463 631. Machine for topping and lifting beets and similar roots.
	463 836. Machine for topping and lifting beets and similar roots.
	464 022. Beetroot lifter.
Hungary,	61 716. Potato lifting machine.
	61 927. Delivery wheel for potato lifter.
	62 097. Two-rowed beet lifter.
Italy,	135 987. Potato lifting machine.

Threshing and winnowing machines.

Belgium,	262 695. Shaker for threshing machine.
France,	464 634. Sheaf elevator.
Hungary,	62 130. Cereal cleaner.
	62 248. Grain sieve.
Italy,	136 041. Threshing and husking machine for wheat and all small seeds.
Switzerland,	63 487. Apparatus for separating stones and earth from cereals.
United Kingdom,	26 055. Threshing machines.
	26 433. Separating wild oats from wheat etc.
United States,	1 087 338. Corn husking machine

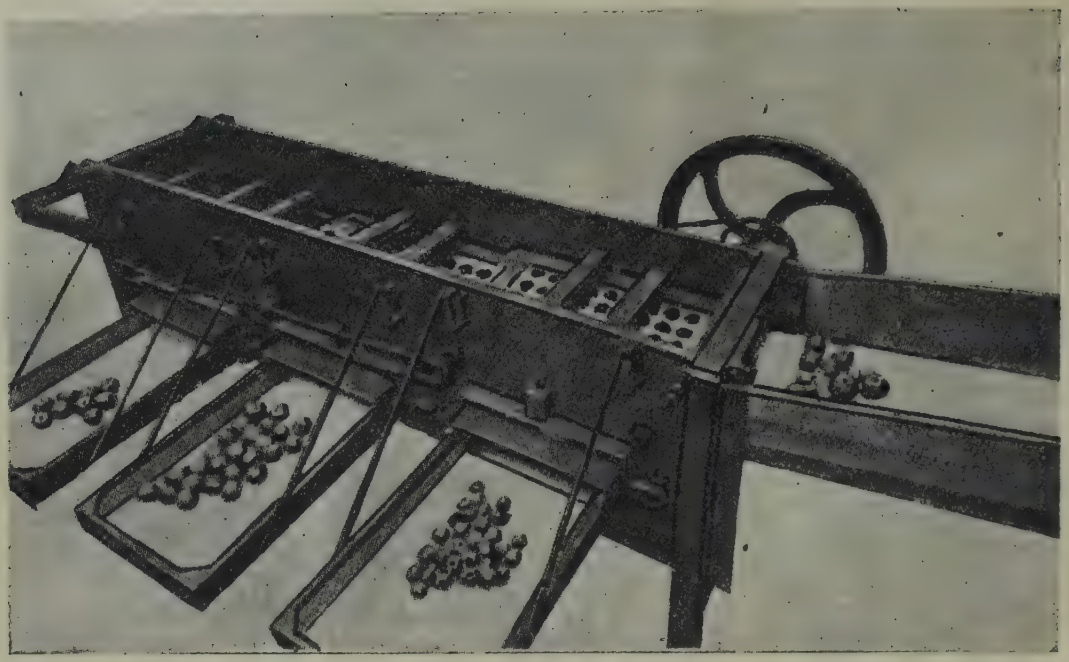


Fig. 3. — Fletcher and Becker's fruit grader (see No. 560).

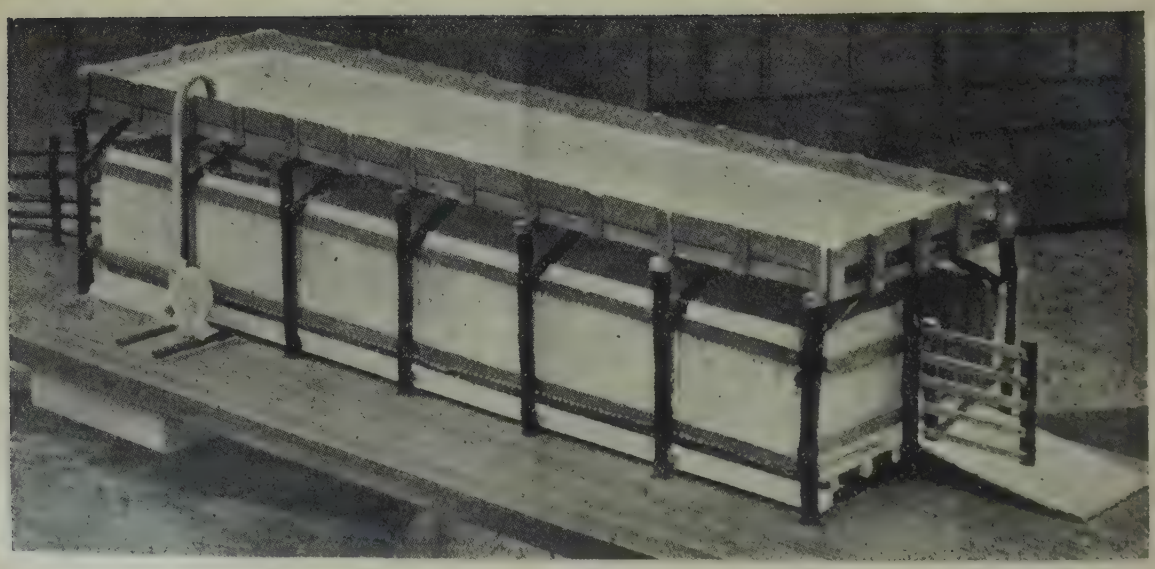


Fig. 4. — Shower-bath sheep dip.

Other agricultural machines and implements.

Austria,	64 616. Groat mill.
	65 010. Drainage and ditching machine.
France,	462 938. Milking machine.
	463 049. Apparatus for milking cows.
	463 625. Attachment for churns for getting rid of the butter milk.
	463 846. Improved sharpener for the knives of chaff cutters and similar machines.
	463 851. Apparatus for charging compressed air sprayers.
	463 895. Device for unfastening animals in stables.
	464 205. Apparatus for protecting crops from frost.
	465 301. Cone-shaped attachment for nozzles of sprayers.
Germany,	272 026. Motor straw elevator.
	272 202. Apparatus for singling plants sown in rows.
	272 205. Ditching plough.
Hungary,	62 046. Beet pulp press.
	62 130. Cereal cleaner.
Italy,	130 970. Esiccators for rice, maize, pomace, etc.
	131 908. Spherical elastic valve for horizontal tube of sprayers.
	134 451. Improved sulphurer.
	135 549. Floating weeding machine.
	135 964. Apparatus for driving automatically any sprayer mounted on wheels.
	136 215. Portable continuous action hydraulic press.
Switzerland,	65 489. Device for introducing honeycomb frames into or removing them from hives.
	63 517. Process for freeing peat from water.
	63 565. Apparatus for extracting the juice of fruit by means of steam.
	63 759. Centrifugal separator.
	63 764. Straw baler.
	63 767. Apparatus for the destruction of pests such as flies, by means of electricity.
	64 646. Machine and process for the preparation of farmyard manure.
	64 702,4. Apparatus for grading and cleaning grain groats, grain, etc., by means of statical electricity.
	64 705. Process and apparatus for the dry preservation of eggs.
United Kingdom,	25 000. Cow milkers.
	25 641. Spraying nozzles.
	25 767. Butter churn, grinder and worker.
	26 032. Machine for treating oil palm fruits.
	26 065. Sharpener for knives of chaff cutter.
	26 322. Driving gear for chaff cutters.
	26 446. Instrument for tapping rubber trees.
United States,	1 087 309. Flax puller.
	1 090 709. Machine for heading Kafir corn.

566. - **The Shower-Bath System of Sheep Dipping.** — *The Implement and Machinery Review*, Vol. XXXIX, No. 468, p. 1660. London, April 1st, 1914.

BUILDING CONSTRUCTION

The accompanying illustration shows the new shower-bath system of sheep dipping, which appears to be finding favour in Queensland. It consists of a shed 40 ft. long by 12 ft. wide, the roof of which is of flat, perforated iron sheets. The dip is pumped by a 3 in. centrifugal pump

from a tank to the roof and falls through the perforations on to the 200 sheep beneath, the shower lasting about seven minutes. The roof edges are turned up to prevent the dip running off and the sides of the shed are enclosed to obviate the blowing about of the dip. There are about 35 holes to the square foot.

This method is proving entirely satisfactory, the cost in one case being stated to be ½ *d* per head. One thousand sheep per hour can be dipped without undue haste by four men.

RURAL ECONOMICS.

567 – **The Economic Importance of Beet Growing.** — SAGAWE, B. in *Archiv für exakte Wissenschaftsforschung*, Vol. 6, Part I, pp. 157-209. Jena, 1914.

The writer examines and discusses the importance of beet growing, and investigates the soundness of the frequently recommended principle: " extensiv organisieren und intensiv kultivieren " (cultivate intensively in extensive farming) which tends to increase the growing of forage plants at the expense of beets.

He mentions first the results of some investigations into the labour required for growing beets by WATERSTRADE, WERNER, DETTWEILER and LANGENBECK, wherein it is shown without exception, that the amount of labour in a farm increases with the proportion of the land under beets. On the other hand the results do not agree as to the difference of the amount of labour required in the most intensive and the most extensive farms. Before diminishing the acreage of beets in favour of forage crops in order to overcome the difficulty of procuring labur, it is necessary to have a clear idea of the consequences of such a change and of the other economic factors involved in beet growing, such as its profitableness, its value as a source of forage and its effect upon the utilization of labour.

All investigations made up to the present have shown that beet growing is one of the most important elements of profits of farms in arable districts. In part 180 of the *Arbeiten der Deutschen Landwirtschafts-Gesellschatf* (Transactions of the German Agricultural Association) LANGENBECK examined the effect of the acreage of root crops on farming conditions in 42 farms and came to the conclusion that the increase of root crops leads to the increase of live stock, to the increase of the value of the dead stock, to the increase of the outlay on artificials, concentrated foods, and salaries and to the increase of the returns from animal and vegetable products, of the net returns and of the capital invested. Part 214 of the *Arbeiten der D. L. G.*, dealing with farming in Silesia, as well as some previous work of the present writer on the profitableness of root crops (1), lead to the same results. The statististics of the Silesian Chamber of Agriculture show that when the farms are arranged according to the percentage of their area devoted to beets the same conclusion is reached. (Table I).

(1) See No. 407, *B.* April 1913. (*Ed.*).

TABLE I.

Root crops per cent of area	Total value per acre	Gross returns per acre	Outlay per acre	Net returns per acre	Interest per cent
	£ s d	£ s d	£ s d	£ s d	
1910-1911					
Under 15	33 2 6	4 14 5	4 17 1	5 2	0.8
15-20	40 13 4	6 1 5	5 3 7	1 1 0	2.6
20-25	43 8 11	7 4 5	5 17 5	1 12 6	3.7
25-30	47 7 11	9 7 8	7 0 1	2 11 2	5.2
Above 30	37 18 8	12 10 5	9 9 4	3 2 8	5.5
1909-1910					
Under 15	44 16 8	5 4 0	5 5 1	15 6	1.7
15-20	34 14 4	4 7 11	14 14 4	1 3 10	3.4
20-25	14 17 4	7 1 7	5 14 4	1 14 6	4,2
Above 25	51 19 6	10 6 8	8 10 7	2 16 8	5.5
1908-1909					
Under 15	45 12 6	5 9 1	5 0 0	7 11	0.9
15-20	37 9 11	5 15 6	5 5 6	17 1	2.3
20-25	38 12 11	6 19 4	5 15 6	1 7 0	3.5
Above 25	51 11 7	9 16 10	7 13 11	2 11 7	5.0

In their work on the returns of Moravian peasant farms (*Ertragsfähigkeit der mährischen Bauernbetriebe*, Brünn 1911) HOWARD and OSTERMAYER come to the same conclusion: that the rate of interest yielded by the capital invested depends directly upon the acreage of the root crops.

The question of the consequences of substituting forage for beet crops can only be correctly solved by a careful comparison of the amount of forage produced by the two crops. The writer makes this comparison, calculating the cost of the forage supplied by both according to their technical food value, and using the values of HOWARD and OSTERMAYER for the purpose. He assumes the leaves of beetroots to be one third of the crop, that the ratio of grain to straw is 1 : 2 in wheat and rye, 1 : 1.5 in oats and 1 : 1.33 in barley, and finds that the cost of production of one hundredweight of food units is as follows:

	According to Howard	According to Ostermayer
	s d	s d
Winter wheat	6 10	7 5
Winter rye	7 1	8 0
Barley	6 8	6 7
Oats	7 6	7 4
Beets	4 4	3 8
Mangolds	— —	8 10
Potatoes	7 11	9 2
Clover hay	— —	4 8
Meadow hay	— —	4 10

According to the above, beets produce the cheapest food units, cheaper than meadows and clover leys. But the question arises whether beets should be compared to hay or rather to fresh clover and grass, as in making hay a considerable loss of food units takes place and the cost of production increases. But as it is generally impossible to feed all the clover and meadow grass in its fresh condition, the writer is of opinion that the comparison of beets and forage plants should not be made between the former and hay, nor between the beets and the green food, but between the food value of part green food, part hay on the one hand and of beet leaves in the state in which they are utilized on the other. Not the quantity at the time of the harvest but the available quantity in the condition in which it is fed, should be calculated, because a certain loss of food units takes place during the storage of roots and leaves. On this plan, the writer has calculated the cost of production of forage, in the state in which it is fed, from twelve yearly accounts of several Silesian farms in different years, and determined the price of one hundredweight of food units in:

	s	*d*
Clover	3	0
Lucerne	3	2
Beets	4	4
Meadow grass	4	9
Mangolds	7	10
Potatoes	7	10 ½

from which it appears that the food unit in beets is dearer than in clover and lucerne, but cheaper than that of meadow grass.

The exclusive consideration of market prices leads to erroneous conclusions, as does the neglect of the unmarketable products produced on a farm, for the farm itself must be considered as the market. The valuation on physiologico-economical basis (1) is also erroneous, because by this method the price of the starch unit delivered at the farm is taken as basis, and thus the unmarketable products are given a value plus cost of carriage, while the marketable ones get a value minus the same. But apart from this it is a mistake to make the starch unit the basis of the price of foods which are not sold in the condition in which they are fed, for this way of valuing, though correct from the physiological point of view, is unsound from the economic point of view, because the unmarketable field products can only be made marketable by means of live stock.

The profitableness of beet growing is much influenced by the valuation of its by-products. If beet leaves could be sold on the market, their value on the farm would be the market price minus cost of carriage. If, therefore, their value is to be calculated from the market prices of the marketable foods, from every hundredweight of the farm forage the cost of transport per cwt. of marketable food must be deducted; the actual cost of carriage of the marketable food must not be set off against the total quantity

(1) See No. 166, *B.* Feb. 1914. (*Ed.*).

of the unmarketable produce. But for beet leaves it does not seem advisable to take the marketable foods as basis of their valuation, on account of the interdependance of beet growing and live stock for the production of stable manure and forage. Beet leaves must therefore be sold to the live stock at a price which leaves a margin of profit for the beet account. This intermediate value of farm bye products varies according to food units, or price per unit in marketable foods minus the cost of carriage per hundredweight, and the minimum value or manurial value plus cost of storage.

The writer then discusses the intimate connection between live stock and beet growing for the utilization of farmyard manure, and shows that from this point of view also a substitution of forage crops for beet would be equivalent to buying dearer forage and getting a lower value for the farmyard manure, and would result in a decrease rather than an increase in the profits from the live stock and consequently from the whole farm, provided that the growing of beets had not yet exceeded its most profitable limits.

With the increased acreage of beet, the utilization of labour improves. The writer proves this by classifying the farms which send their books to the book-keeping office of the Silesian Chamber of Agriculture according to the acreage devoted to beets, and calculates the ratio of outlay on labour to gross returns (Table II).

TABLE II. — *Wages in percentage of gross returns.*

Year	Acreage in root crops				
	less than 15 %	15-20 %	20-25 %	25-30 %	above 30 %
1910-11	39	35	31	28	26
1909-10.	41	36	32	27	23
1908-09.	35	36	31	27	60
Average . . .	38	36	31	27	23

The larger the relative acreage of root crops the smaller the outlay on wages required for the same gross returns. This result is due to the well known fact that with increasing intensity of farming labour diminishes in relation to the capital invested. The higher absolute outlay on labour is justified by the increasing profits of the farms, the means of which for the three years amount to 1.1, 2.8, 3.8, and 5.2 per cent. respectively for the first four groups.

The same results are obtained from farms under the book-keeping control of the D. L. G. using LANGENBECK's and OSTERMAYER's figures. In order to show that these results are not due to the improvement in the quality of the soil and in the economical conditions of the beet farms rather than to the increase of root crops, the writer shows that by grouping the farms according to their increasing total value, the amount of labour employed in the D. L. G. farms shows no difference, that the figures of the Silesian farms show an increase in the amount of labour employed but

that the increase is quite insufficient to account for the fall of the ratio with the increased acreage of root crops.

The statement that beet growing is often pushed beyond its most profitable limits is not confirmed by the results of the accounts, which show that the interest on the capital invested still gives an increase when the root crops attain upwards of 35 per cent of the total acreage, notwithstanding the fact that the proportion of net returns to gross returns or the factor "value according to returns" (Ertragswert) appears to reach its highest limit with about 30 per cent. of the total acreage under roots. In order to determine the optimum limit of any crop which has reached the ultimate profitable limit of outlay, it is not enough to consider only the absolute value of the net returns or the ratio of outlay to gross returns, but rather the rise or fall of the rate of interest on the total capital. The figures calculated on these lines for the D. L. G. farms show that cereal crops reach the optimum limit of profitableness and in the use of labour at about 60 per cent., while root crops attain this same limit at about 30 per cent. with regard to the use of labour but not with regard to the highest rate of interest. It follows that such districts as do not seem especially suitable to extensive forage crops on account of their position and natural conditions should only devote a relatively small percentage of their area to these crops.

568 – **The Consumption of Artificial Manures in Intensive Agriculture.** — HAGMANN in *Landwirtschaftliche Zeitschrift für die Rheinprovinz*, Year 15, No. 16, pp. 315-316. Bonn, April 17, 1914.

One of the most valuable means of judging the degree of intensity of the cultivation of a farm is a knowledge of the kind and amount of the artificials used on it; thus the average outlay on artificials in the year 1912-13 on 36 farms in the Russian Baltic provinces was 2*s* 6*d* per acre of cultivated land, on 145 farms in East Prussia 7*s* 4*d*, and on 18 intensive farms of the Rhine province £1 5*s* 4*d* per acre. These figures afford a better index of the degree of intensity than any other item of expenditure.

In the total outlay for the Rhine province, nitrate of soda and sulphate of ammonia amount to 6*s* 5*d*, "Ammoniaksuperphosphat" (a mixture of superphosphate and sulphate of ammonia) to 12*s* 10*d*, superphosphate and basic slag to 2*s* 4*d*, potash salts and kainit to 2*s* 5*d*, and lime to 1*s* 4*d*. If these figures be classed according to the percentage of the various elemental plant nutrients, it will be found that nitrogen represents about 60 per cent., phosphoric acid 25 per cent. and potash and lime each 15 per cent.

The two principal sources of nitrogen are farmyard manure and artificials. The question of the best proportion in which these two are to be used is of great importance with regard to the profitableness of the whole farm. As the number of live stock kept increases, the necessity of supplying nitrogen in the form of artificials decreases, as is shown in the 18 Rhineland farms which are divided into two groups according to the amount of live stock kept, with the following results (Table I):

Groups	Number of farms	Live stock per ahie		Outlay for artificials per acre					
		Total	Cattle	Total	Nitrate of soda and sulphate of ammonia	Superphosphate of ammonia	Superphosphate and basic slag	Potash and kainit	Lime
		£ s d	£ s d	£ s d	£ s d	£ s d	£ s d	£ s d	£ s d
I	9	8 1 1	4 9 8	1 1 0	0 5 8	0 10 10	0 1 11	0 1 11	0 0 8
II	9	5 19 5	2 11 12	1 9 7	0 7 1	0 14 11	0 2 11	0 2 12	0 1 11

The outlay on artificials is much greater in group II than in group I and especially is this the case for nitrogen. The gross and net returns are very similar in both groups, as the difference in the amount of live stock kept is not large. If, however, farms are taken where the difference is greater, the influence of the live stock on the amount of fertilizers purchased, especially of nitrogen, as well as on the profitableness of the farm is more evident. The writer has taken from the *Arbeiten der Deutschen Landwirtschafts-Gesellschaft*, Part 130, the figures relating to 20 sugar-beet farms in Saxony, 10 of which keep much live stock and the other 10 only a limited quantity, other conditions being equal. It appears that the first group, which keeps 31.56 units of live stock per 100 acres buys 337 lbs. per acre of nitrate of soda and sulphate of ammonia annually, while the second group, which keeps only 12.54 units per 100 acres, consumes every year 713 lbs. per acre. The consumption of « Ammoniaksuperphosphat » is approximately equal, *viz.* 301 lbs. per acre in the first group and 298 lbs. in the second. The net returns are £4 4*s* 11*d* per acre in the first group and £2 12*s* 5*d* in the second. The above figures prove clearly that the net profits are connected with the quantity of live stock kept on the farm and increase with it. The writer is therefore of opinion that in every farm where large quantities of nitrogenous fertilizers are bought regularly, it should be ascertained whether the amount of live stock could not be increased and the amount of purchased fertilizers correspondingly decreased.

AGRICULTURAL INDUSTRIES.

DAIRYING

569 – **Determination of the Viscosity of Milk as a Means of Detecting the Addition of Water.** — KOOPER, W. D. (Communication from the Laboratory of GERBER Co. LTD., Leipzig) in *Milchwirtschaftliches Zentralblatt*, Year 43, Part 7, pp. 169-179 and Part 8, pp. 201-208. Hanover, April 1 and 15, 1914.

The writer examined 50 different mixed milks, with the object of investigating the question of utilizing the viscosity of milk as a means of detecting the addition of water. The fat content and specific gravity

were determined at the same time by the Gerber and lactometer tests respectively, and the total dry matter was calculated from these values by Fleischmann's formula. The viscosity was determined by means of a specially constructed burette-shaped apparatus. This was first filled with distilled water, then with milk; for both, the time required for the outflow of 10 cc. was observed.

$$\text{Viscosity constant, V} = \frac{\text{outflow of milk, time in seconds}}{\text{outflow of water, time in seconds}}$$

In order to get comparable results, the tests must be carried out at uniform temperature, differences of 0.5° C. (0.9° F.) having a perceptible effect, and the bore of the outlet must be adjusted so that the outflow be neither too fast nor too slow. The milk must be thoroughly well mixed before being poured into the burette, without subjecting it to too violent shaking which might cause a change in the natural viscosity of the liquid. The time required for the outflow must be determined with precision to within one-fifth of a second.

A high viscosity constant is usually associated with a high fat content, but the rule is not infallible, nor is the ratio of the specific gravity to viscosity constant more reliable. On dividing the average viscosity constant (1.588) by the average dry matter of the milk (11.472 per cent.), the factor 0,1384 was obtained, and if there be any constant relationship whatever between viscosity and dry matter content, the dry matter of any one sample (or T) should be given by the formula :

$$\frac{V}{0.1384} = T$$

On comparing values thus obtained with those obtained by using the Fleischmann formula for the 50 samples investigated, it appeared that the greatest divergence between the two methods amounted in one case to 0.36 per cent. All the other samples showed smaller differences, so that the writer concluded that a direct relationship existed between variations in the viscosity and the dry matter content of milk.

In using the viscosity constant for detecting the addition of water to milk, experiments showed that under certain conditions watered milk can yield the same viscosity constant as unadulterated milk, in which case the value obtained for T is too high; the greater the amount of water added to the milk the greater is the difference between the real and calculated value for dry matter, owing to the fact that the watering causes the amount of dry matter to diminish more rapidly than the viscosity constant. If a milk for instance with 11.472 per cent. of dry matter and a viscosity constant of 1.588 be mixed with an equal quantity of water, the percentage of dry matter would be reduced to $\frac{11.472}{2} = 5.736$; but the viscosity constant would only be reduced to about $\frac{1.588 + 1}{2} = 1.294$. From this :

$$T = \frac{V}{0.1384} = \frac{1.294}{0.1384} = 9.349 \text{ per cent.};$$

that is, the difference between the real and calculated values for the dry matter would be :

$$9.349 - 5.736 = 3.613 \text{ per cent.}$$

The difference between the amounts of dry matter determined by the two methods therefore affords an easy and rapid way of ascertaining whether milk has been watered, and if so to what extent. The writer recommends that the question be further investigated.

570 – **Biorized Milk** (1). — KLUNKER, chief physician to the Institute of Hygiene at the University of Jena, in *Molkerei Zeitung*, Year 28, No. 33, pp. 625-626, No. 34, pp. 639-640. Hildesheim, April 29, May 1, 1914.

The above paper is a preliminary communication of an investigation of LOBECK'S milk sterilization process, carried out at the Institute of Hygiene, University of Jena, with an experimental apparatus capable of treating 2.64 gallons per hour. Samples of biorized milk from Leipzig, Chemnitz and Düsseldorf, where the process is in use, were sent for comparison, and the results obtained are as follows :

1. The whole apparatus is easy to handle, to dismount, to clean and to disinfect. The daily initial loss of milk is very small.

2. The biorized milk (called by LOBECK "enzyme-milk") is equal in colour, appearance, smell and taste to the best raw milk.

3. This milk is somewhat less easily skimmed than raw milk, but at the temperatures employed, *viz.* 131 and 135° F., the difference is so small that it would be imperceptible to consumers. Equally good results can only be obtained with heated milk if the temperature be kept below 113° F. and the heating be continued for half an hour ; no milk pasteurized in any other way approaches biorized milk in this respect.

4. The original enzymes (oxydases) of natural milk are not influenced by biorization ; the milk proteins undergo no change. On the other hand coagulation proceeds more slowly but is not weakened.

5. Biorization causes such a decrease in the germ content that the keeping quality of the milk is more than doubled. As moreover the heating to 131 and 135° F. does not destroy the lactic acid producers, there is no danger that the milk will be spoiled while on sale by the prevalence of spore-forming bacilli. Biorized milk can therefore compete with fresh, cleanly milked raw milk as food for babies.

6. Disease-producing germs, such as typhus, paratyphus, diarrhoea, cholera and diphtheria bacilli, are destroyed with absolute certainty. The destruction of the tubercle bacilli is less certain, but experiments seem to indicate that they do not resist the treatment.

The new process would appear to mark a distinct forward step towards supplying a hygienic, wholesome milk to the public..

(1) See: No. 743, *B.* June 1913; No. 1190, *B.* Oct. 1913; No. 1389, *B.* Dec. 1913. (*Ed.*)

571 – **The Effect of Certain Dairy Operations upon the Germ Content of Milk.** — HARDING, H. A., RUEHLE, J. K. etc., *New York Agricultural Experiment Station, Bulletin* No. 365, pp. 197-233. Geneva, N. Y., August 1913.

Bacterial counts were made in milk samples produced under various conditions of hand-milking. Neither plastering nor whitewashing the byre, nor clipping the udder and flank of the cows, nor the use of a vacuum machine for cleaning the cows preparatory to milking, seemed to have any effect on reducing the bacterial content of the milk; in fact the opposite effect was usually observed. A series of tests carried out on samples drawn from the milking pail, from the cooler, and after final straining, indicated that the germ content of the milk was not increased by the handling it received on the farm subsequently to the milking operation.

572 – **The Origin of Some of the Streptococci Found in Milk.** — ROGERS, L. A. and DAHLBERG, A. O. (Bureau of Animal Industry) in *Journal of Agricultural Research*, Vol. I, No. 6, pp. 491-511. Washington, D. C., March 1914.

A collection of cultures of streptococci was made, of which 42 were isolated from normal milk, 51 from infected udders, 114 from bovine faeces, and 39 from the mouths of cows. These were all subjected to a large number of tests and tabulated according to their behaviour on gelatine and in media containing dextrose, lactose, saccharose, raffinose, starch, inulin, mannite glycerin, dulcite and adonite. The cultures fall into groups according to the nature of the material from which they were originally isolated.

WINE-MAKING.

573 – **Improvement of Damaged Wines and Spirits.** — ZWEIFLER, F. in *Allgemeine Weinzeitung*, No. 18, pp. 185-186. Vienna, 1914.

The writer carried out some experiments on the improvement of damaged wines at the Agricultural Experiment Station of Marburg (Styria), during which the following results were obtained.

1. A turbid highly coloured wine with a musty odour and taste was treated with sesame oil, but ineffectually. On increasing the dose of oil the smell of the latter was communicated to the wine. On adding 0.16 oz. of Eponit (1) per gallon of wine and filtering it after six days, the wine became light coloured and clear, and tasted clean.

2. Another wine that had become dark brown was treated with 0.008 oz. of sodium bisulphite, 0.0096 oz. of gelatine and 0.008 oz. of tannin per gallon, with the result that the colour became clear and the wine kept well. Equally good results were obtained by using 0.064 oz. of Eponit and 0.008 oz. of sodium bisulphite alone.

3. A sour turbid wine with a taste of the cask (total acidity 12.7 per thousand) on being treated with 0.24 oz. of precipitated carbonate of lime, 0.0192 oz. of gelatine and 0.016 oz. of tannin per gallon, became clear and mild and pleasant to the taste. Sesame oil had no other effect than that of imparting its smell to the wine.

(1) "Eponit" is a vegetable charcoal, a new clarifier which has given good results. It is sold by the AKTIEN GESELLSCHAFT DER OESTERREICHISCHEN CEREIN FABRIK, late H. UJHELY AND Co., of Stockerau near Vienna.

4. White wine made with red grapes was decoloured in order to blend it with another white wine. In one case 0.12 oz. of Eponit per gallon was sufficient, while another wine required 0.16 oz. per gallon.

5. Two plum brandies which had become black were clarified, one with tannin and gelatine, and the other with skimmed milk; the results were imperfect in both cases, while 0.368 oz. of Eponit, though working slowly, rendered the brandy perfectly clear and its taste quite clean. An equally good result was obtained by adding water to the brandy and redistilling it.

PLANT DISEASES.

GENERAL INFORMATION.

LEGISLATIVE AND ADMINISTRATIVE MEASURES

574 – **Decree Placing *Mytilaspis citricola* (= *Lepidosaphes beckii*) amongst Notifiable Insects in Uruguay.** — *Revista de la Asociación rural del Uruguay*, Year XIII, No. 12, p. 883. Montevideo, 1913.

At the request of the " Defensa Agrícola ", and on evidence of damage caused by this insect to orange plantations in certain districts, the President of the Republic issued a decree, dated October 25, 1913, that *Mytilaspis citricola* (*Lepidosaphes beckii*) should be classed as an insect injurious to plants according to art. 7 of the law of October 21, 1911.

DISEASES NOT DUE TO PARASITES AND OF UNKNOWN ORIGIN.

575 – **Observations and Researches on "Dörrfleckenkrankheit" (Dry spot Disease) of Oats.** – HILTNER, L. in *Praktische Blätter für Pflanzenbau und Pflanzenschutz*, Year 12, Part 3-4, pp. 28-41, 1 fig. Stuttgart, March-April 1914.

A disease of oats generally called " Dörrfleckenkrankheit " has been observed in various districts in North Germany during recent years and has frequently appeared in Holland, Denmark and Sweden. The leaves develop normally at first, but fairly early lose their turgescence at the bends ; the wilted portions soon change colour and perish. If the disease appears when the plants are young, as is often the case, the yield of the crop is greatly reduced, since many of the panicles do not emerge from their sheaths.

The disease has been attributed either to a fungus, *Scolecotrichum graminis*, or to root nematodes, or to the frit fly (*Oscinis frit*). The majority of observers, however, consider it due to unfavourable soil conditions, particularly the percentage of lime.

Pot culture experiments carried out by the writer (Director of the Agricultural Botanical Station of Munich) show that : 1) the disease apparently does not occur on compact clay soils ; 2) it appears in cultures

of ordinary garden soil containing lime, without direct addition of lime ; 3) treatment of this soil with carbon disulphide does not prevent the outbreak of the disease ; 4) no disease appears on soil treated with quicklime and carbon disulphide, but carbonate of lime and carbon disulphide are without effect in checking the disease. The effect of the quicklime in combination with carbon disulphide is accounted for by its action on the increased ammonia produced after the treatment with carbon disulphide, resulting in increased nitrification and the formation of calcium nitrate.

In field cultures the disease increased considerably after abundant rain ; this causes the formation of bicarbonates of soda and potash by double decomposition of alkaline salts with the carbonate of lime in the soil.

Water cultures lead to the conclusion that the disease is not caused by the presence of lime itself, but by the resulting decomposition products formed either in the soil or in the leaves of the oats. The researches show that : 1) in nutritive solutions containing monopotassium phosphate, normal development of the oat and other plants is impossible when the solution is made with un-neutralised tap-water containing lime ; chlorosis develops rapidly owing to the alkalinity of the surface-film of the solution, and the functions of the roots are checked ; 2) in Knop's solution made with Munich tap-water neutralised with sulphuric acid, the oat plants develop relatively better, but the leaves are subject to the disease ; the chemical decomposition causing the alkaline reaction evidently takes place in the leaves in this case ; 3) since the addition of monopotassium phosphate to garden soil containing lime can cause the development of the disease in oats, it is concluded that as in the case of water cultures, the appearance of the disease is determined chiefly by the alkaline decomposition products formed in particular by the action of the bicarbonate of lime.

The different varieties of oats show varying degrees of resistance to the disease. Pot cultures have shown that the variety Leutewitzer Yellow is more resistant to the frit fly than Fichtelgebirg, and that it remains free from disease in garden soil rich in lime, whilst Fichtelgebirg is badly attacked. In soils poor in lime the disease does not appear in either variety. The writer considers the yellow varieties less susceptible to the metabolic disturbances which give rise to the disease. The fungus *Scolecotrichum* appears later on all the diseased plants, but it cannot be the cause of the disease since it is only developed to any considerable extent on certain types of soils.

The functional disturbances of the leaves may be prevented by spraying with a solution of iron salts. A diseased culture of Fichtelgebirg oats was effectively cured after four sprayings with ½ to 2 per cent. solutions of iron salts. Tartrate of iron gives the best results.

It has also been found that oats which have become chlorotic owing to the presence of alkaline substances in the nutritive medium, or which suffer from the disease owing to the formation of injurious alkaline products in the leaves, can be cured by spraying with salts of iron. This would explain the satisfactory development of oats which is often noted after spraying for wild radish with sulphate of iron.

The writer has also determined the identity of the disease known as "Hafersucht" in the Bavarian Alps, and "Holsternische Haferkrankheit" or "Moorkoloniale", with "Dörrfleckenkrankheit" The researches are being continued to determine the effects of acid and alkaline fertilizers.

576 – **The Presence of Endocellular Fibres in the Tissues of the Vine and of other Dicotyledons** (1). — MAMELI, EVA in *Atti dell'Istituto botanico dell'Università di Pavia*, Series II, Vol. XVI, pp. 47-65, plate VIII. Milan, 1914.

In this summary the writer fully confirms her preceding observations (2).

The presence of endocellular fibres is frequent, not only in the vines affected by bramble-leaf (roncet), but also in healthy ones (86 per cent.) ; vines grown in districts hitherto free from bramble-leaf and showing no exterior symptoms of this disease or of decay, may contain these endocellular fibres even in the two-year-old canes.

Between healthy vines and those suffering from bramble-leaf, there is no difference at all either in the form or in the frequency of the fibres : these may be rare or wanting altogether in both.

The formation of the fibres cannot be attributed to falls of temperature, because their presence has been ascertained by the writer in vines and other plants grown for several years in hot-houses.

The writer has found these fibres in *Vitis vinifera* L. and *V. heterophylla* Thunb., as well as in nineteen other dicotyledonous plants belonging to the most different families, so that their presence has no connection with any pathological condition of the plant which contains them. The origin and function of the endocellular fibres are in all probability mechanical.

BACTERIAL AND FUNGOID DISEASES.

GENERALITIES

577 – **Phytopathological Observations in the Grand Duchy of Baden, 1913.** – WAHL, C. von and MÜLLER, K. in *Bericht der Hauptstelle für Pflanzenschutz in Baden an der Gossherzogl. landwirtschaftl. Versuchsanstalt Augustenburg für das Jahr* 1913, pp. 70, + 5 figs., append. I and II. Stuttgart, 1914.

A list is given of the cultivated plants and their pests observed during 1913.

Phylloxera (*Phylloxera vastatrix*) was recorded for the first time in the Grand Duchy of Baden. *Conchylis ambiguella* caused serious damage, whilst the vine mite (*Phyllocoptes vitis*) and the vine tortrix (*Tortrix pilleriana*) have diminished.

American gooseberry mildew (*Sphaerotheca mors-uvae*) has spread everywhere.

Experiments on the destruction of meadow saffron (*Colchicum autumnale*) have been started ; the seeds are not distributed by irrigation,

(1) See No. 480, *B.* May 1914. (*Ed.*).
(2) See No. 1207, *B.* Oct. 1913 and No. 289, *B.* March 1914. (*Ed.*).

since they sink in water, but apparently by means of hay seeds; in 4 ½ lbs. of hay seeds 790 of these seeds were found.

Experiments on protective measures against plant pests.— Comparative trials of the fungicidal action on vine mildew (*Plasmopara viticola*) have been made with certain commercial fungicides and Bordeaux mixture. "Cerdidymsulfat", "Malacidschwefel" and "Laykoschwefel" were tried and found inferior to Bordeaux mixture. They were particularly useless against mildew in 1913, when the weather was very favourable to the disease.

Applications of 20 per cent. solutions of sulphate of iron were used against the "Grind" disease of the vine, with only partial success; the disease reappeared on the treated vines but in a less degree.

Experiments on the destruction of charlock and radish have shown again the value of a 20 per cent. solution of sulphate of iron, a dressing of kainit of about 90 lbs. per acre, and a 20 per cent. solution of "cuproazotin." (1). Calcium cyanamide at the rate of 1 cwt. per acre did not come up to expectations.

"Malacidschwefel" does not fulfil its claims in the destruction of aphids. "Urania-Grün", based on aceto-arsenite of copper, produces a more permanent suspension in water than "Malacidschwefel", but is not more effective.

Prof. Lang's "Schwefelaluminiumpatronen" were not successful against hamsters and rabbits, owing to the depth of their winter burrows, but they were effective against water voles.

Immersion of seeds in creolin, carbolineum, or formalin and coal-tar is not a safe protection against the attacks of birds. Carbolineum in 5 per cent. solution is injurious to the germinating power of the seeds.

Various observations.— The results of the investigations on the introduction of phylloxera into the Grand Duchy are not conclusive; it does not appear to have been due to winged individuals coming from Upper Alsace.

Winter spores of *Plasmopara viticola* have been found in abundance on vine leaves, and the perithecia of the powdery mildew (*Uncinula necator*) were abundant on vines near houses at Durlach.

Infection experiments on *Rhytisma acerinum*, the fungus of sycamore leaf-blotch, have confirmed former experiments, which showed that infection takes place on the under side of the leaf and not on the upper surface as maintained by Tubeuf.

The organization against plant diseases in the Grand Duchy has been still further improved by the collaboration of lecturers on fruit and vine growing, and by the creation of a station for purchasing the materials required. The Central Station for the Protection of Plants organises special visits to farms where modern methods of control are demonstrated and lectures are held to stimulate the interest of farmers in the aims of phytopathology.

(1) Supplied by Ludwig Meyer, Mainz; price abont 30s per 100 lbs.

FUNGI

578 – **Some Chinese Fungi** (1). — MIYAKE ICHIRO, in *The Botanical Magazine*, Vol. XXVIII, No. 327, pp. 37-56, plate I. Tokyo, March 1914.

A systematic catalogue of more than one hundred species and varieties collected by the writer in various localities during the summer of 1912. The majority were found on cultivated or economic plants. Of the seven species new to science the following are worthy of mention: *Rehmiella ulmicola*, on the leaves of *Ulmus* sp.; *Coniothyrium Tiliae*, on the leaves of *Tilia cordata; C. Spiræae*, on the leaves of *Spiraea pubescens; Septogloeum Anemones*, on the leaves of *Anemone* sp.

The following species are already known: *Gymnosporangium Yamadai* Miyake, common on leaves of *Pyrus Malus* and *P. spectabilis* near Pekin; the disease often spreads so rapidly in June and July that all the foliage turns yellow, dries up and falls; *Aecidium Mori* Barcl., on the leaves of *Broussonetia Kazinoki* and *Morus alba*, widespread and injurious in Japan; *Helminthosporium Onyzae* Miyake and Hori; from observations made by the writer, this latter fungus is not so widely distributed or dangerous in China as in Japan.

579 - **Wintering of Cereal Rusts in the Uredo Stage.** — MONTEMARTINI, LUIGI in *Rivista di Patologia vegetale*, Year 7, No. 2, pp. 40-44. Pavia, 1914.

The writer reviews the results of other workers on the persistence of the uredospore stage during the winter months. He records the fact that at Pavia and in its Province this form of rust occurs on wild and cultivated Gramineae, which continue green after harvest, and that it may reinfect the wheat plant at any time. Thus, autumn-sown wheat may be directly infected, and if the season is warm and late the disease makes its appearance. The uredo stage also appears to be able to resist several degrees of frost for many days. Further observations are required to determine the temperature which is fatal to the parasite. Under Italian conditions it seems more probable that the infection of the wheat crop takes place by means of uredospores from diseased plants during the autumn, rather than by transmission through the seed as supposed by Eriksson.

The spread of the disease is therefore influenced by the growth of grasses, the summer weather (during hot, dry summers, when grasses dry up, the uredo stage gives place to the teleuto stage), the period of sowing and the autumn and winter weather.

580 - **Inoculation Experiments on Potatoes with *Fusarium*, 1913.** — HIMMELBAUR, W. in *Oesterreichisch-Ungarische Zeitschrift für Zuckerindustrie und Landwirtschaft*, Year XLIII, Part I, pp. 1-16. Vienna, 1914.

Experiments were carried out in 1913 to confirm the results obtained in 1912 on a small scale. Inoculations were made, as in 1912, of vigorous material, using mycelium only. In addition to direct insertion in the tissues of the plant, inoculations of the soil were made in the immediate neighbourhood of the plants. The experiments were begun on the 10th

(1) See also No. 754, *B.* June 1913. (*Ed.*)

of July, and the inoculations were made on fine days between 6 and 8 a.m. in the open fields which had previously shown no sign of the disease. It was found that inoculations of the potato haulm resulted in the appearance of leaf-curl, thus proving that one form of leaf-curl in potatoes is due to infection of the haulms by the various forms of *Fusarium* (and also *Verticillium*).

581 – **A Leaf Disease of *Cycas revoluta*.** — MARCOLONGO, I, in *Rivista di Patologia vegetale*, Year 7, No. 1, pp. 6-8. Pavia, 1914.

For many years a number of specimens of *Cycas revoluta* in Naples have been attacked by a leaf-disease, characterised by small round yellow spots with dark edges, which extend until the whole segment of the leaf is yellow. A slight greenish mould appears on the underside of the leaf and thickens as the disease advances. Microscopic examination has shown that this disease is due to a new species of *Cladosporium*, provisionally described as *C. Cycadis*.

In gelatine cultures nothing has been obtained but a pycnidial form, capable of reproducing itself from the stylospores. Inoculations of healthy leaves with either the conidial (*Cladosporium*) or the pycnidial (*Phoma*) stage, have produced the characteristic symptoms of the disease.

582 – ***Cylindrosporium Juglandis* injurious to the Leaves of Walnut in Alabama.** — WOLF, A. in *Mykologisches Centralblatt*, Vol. IV, Part 2, pp. 65-69 + figs. Jena, March 1914.

During the last two years walnut trees at Auburn, Alabama, have shown a new leaf disease characterised by numerous irregular dry spots which appear on both sides of the leaf. The spots are brown in colour with a central grey spot indicating the point of infection. Some spots are uniformly brown and others become uniformly grey owing to the entrance of air below the raised cuticle. The adjacent tissue often becomes chlorotic. A single leaf may develop from 500 to 1000 or more centres of infection, which may remain distinct or may join up so as to cover the whole leaf surface. In the summer of 1912 a small plantation was so badly attacked that the trees were completely defoliated on two occasions before the normal period of leaf-fall.

The disease is caused by a *Cylindrosporium*, the fructifications of which appear on the under sides of the leaves. The fungus has been isolated in pure cultures and reproduced with success in various media, but no perithecia have been obtained in artifiicial cultures. Supposing that the conidial stage survives on the fallen leaves until the new leaves appear, it does not seem probable that perithecia are produced in the neighbourhood of Auburn. It is probable that the perfect form of this fungus could be produced under certain conditions, as in the case of other species of *Cylindrosporium*.

Experiments in 1913 showed that the disease could easily be kept in check by destroying all fallen leaves from the diseased trees, and using Bordeaux mixture on the appearance of the disease. The writer describes this fungus as *C. Juglandis*.

PARASITIC AND OTHER INJURIOUS FLOWERING PLANTS.

583 – **Experiments on the Destruction of Charlock *(Sinapis arvensis)* by Mechanical and Chemical Means.** — LEUTZ, J. VON in *Praktische Blätter für Pflanzenbau und Pflanzenschutz*, Year XII, Part 3-4, pp. 43-46. Stuttgart, March-April 1914.

The results of two years' experiments show that rolling is more effective than spraying with sulphate of iron for destroying charlock; it must be done as soon as the oats appear above ground. The rolling must be very thorough, so as to crush all the charlock seedlings, and is best repeated asecond time; on stony or cloddy land this method is not applicable.

INSECT PESTS.

GENERALITIES

584 – **Relation between the Larvae of Vine Moths (*Conchylis ambiguella* and *Polychrosis botrana*) and the Weeds of Vineyards and Other Plants.** — LÜSTNER, GUSTAV, in *Zeitschrift für Weinbau und Weinbehandlung*, Year I Part I, pp. 3-35. Berlin, 1914.

The writer has conducted numerous experiments to determine what foods other than the flowers and fruits of the vine are available for these insects during their larval stage. He tried the larvae with 92 species of plants, the majority being vineyard weeds, others hedgerow and ornamental plants.

In the case of the *Conchylis* larvae the experiments were carried out from the beginning of September to the middle of October. The larvae were observed to be distinctly polyphagous, even devouring Euphorbiaceous plants. It will therefore be difficult to prevent the larvae from feeding on the first buds and fruits by means of disagreeable substances. They are also ready to devour the parts of the plant (*e. g.* the tips of shoots and young leaves, etc.) that are not generally found to be attacked.

The experiments with *Polychrosis* larvae were carried out in the spring and the larvae were found to be equally polyphagous.

These experiments show that: 1) these pests may continue to feed on the shoots of the vine, or failing this, on common weeds, so that measures for the control of the pest by the immediate consumption of the fruit attacked, are not adequate; 2) enclosing the bunches of grapes in bags serves to protect the fruit, but does not decrease the danger of the spread of the insects; 3) brushing the first shoots showing signs of attack is not effective in destroying the larvae, since they find shelter elsewhere, and further this procedure is liable to cause damage to the young vine shoots.

MEANS OF PREVENTION AND CONTROL

585 – ***Thripoctenus brui* n. sp., a Chalcid Parasite of *Frankliniella robusta*, injurious to Peas in France.** — VUILLET, A. in *Comptes rendus hebdomadaires des séances de la Société de Biologie*, Vol. LXXVI, No. 13, pp. 552-555, figs. 1-3. Paris, April 10, 1914.

Garden peas are sometimes seriously damaged by attacks of the pea thrips (*Frankliniella robusta*), which, in 1913, caused considerable damage

near Montargis (Loiret). The writer describes a hymenopterous parasite of this insect, which is new to Science, under the name of *Thripoctenus brui*. The description is based on numerous specimens occurring among the larvae and nymphs of *F. robusta* in the flowers of peas, broad beans and sweet peas collected at Dercy (Aisne) in July 1913. *T. brui* is clearly distinguished by several characters from *T. russelli* Crawford, the only other known species of the genus, parasitic on the bean thrips (*Heliothrips fasciatus* Pergande) in the United States.

The writer received a large number of specimens of *F. robusta* from near Montargis in 1913, but found no specimens of the parasite which was so abundant at Dercy during the same season. It would appear useful to distribute the flowers of peas and beans containing *T. brui* with a view to controlling the spread of *S. robusta* in the same way that Del Guercio (1) has controlled the olive thrips (*Phloeothrips oleae* Costa) by means of *Tetrastichus gentilei*.

586 – **Destruction of *Conchylis* Larvae by Lad birds.** — LÜSTNER, GUSTAV in *Zeitschrift für Weinbau und Weinbehandlung*, Year 1, Part 2, pp. 65-69. Berlin, 1914.

The writer has observed that the larvae of the first generation of *Conchylis ambiguella* Hub. are devoured by the adult *Coccinella septempunctata* when aphids are lacking. They are not attacked by the larvae of *C. septempunctata* and only to a slight extent by the adult *C. decempunctata*. When protected by their silky web they are not attacked by any *Coccinella*.

587 – **The Destruction of Woolly Aphis *(Schizoneura lanigera)* and Pear Scale *(Epidiaspis betulae)* by Fumigation with Hydrocyanic Acid.** — LÜSTNER, GUSTAV in *Deutsche Obstbauzeitung*, Part 8, pp. 174-176, 1 fig.. Stuttgart, April 15, 1914.

Hydrocyanic acid fumigation has long been employed in America, but was introduced into Germany by the writer. Attempts to fumigate apple and pear trees to destroy *Schizoneura lanigera* and *Epidiaspis betulae* (= *E. pyricola*) have not met with success, and the expense is so great as to make the method impracticable for the treatment of fruit trees.

588 – **The Chinch Bug (*Blissus leucopterus*), injurious to Cereals in Kansas.** — HEADLEE, THOMAS J. and MC. COLLOCH, JAMES WALKER, in *Kansas State Agricultural College, Agricultural Experiment Station, Bulletin No.* 191, pp. 285-353, figs. 1-13, plates I-VII. Manhattan, Kansas, 1913.

The chinch bug existed in Kansas before the country was colonised. It hibernates on bunch grass (*Andropogon scoparius* Michx.), big bluestem (*A. furcatus* Muhl.) and false red-top (*Triplasis purpurea* Walt.), from which it migrates in early spring to wheat and other cereals. The first generation reaches maturity just after harvest, and finding itself short of food, it migrates to adjacent crops of maize and sorghum, where the second generation reaches maturity in the autumn. The insect then hibernates on waste grasses.

The larvae as well as the adults damage their host plants by piercing

(1) See No. 3027, *B.* Aug.-Sept.-Oct. 1911. (*Ed.*).

the cortex, extracting the sap and destroying the tissues adjacent to the wound. The damage to crops in Kansas amounts to several million dollars annually, owing to the reduction in the yield of wheat and sometimes complete destruction of the maize and sorghum crops.

Dry seasons are particularly favourable to the development of this pest. Moist weather effectively destroys it by burying the eggs and larvae and by exposing the adults to the attacks of the fungus *Sporotrichum globuliferum* Speg,, which is the only natural parasite of this insect. This fungus is widely spread throughout the regions affected by the pest, and when conditions are favourable it becomes a powerful epidemic. The most favourable conditions are a temperature of 24° C. and humidity approaching saturation.

Careful experiments have shown that it is not possible to spread the infection of the fungus by artificial means, and much money has been uselessly expended in adopting this method of control in Kansas. The most precise experiments have shown that destructive measures can be successfully applied twice a year, *viz.* during the migration of the first generation from the cereal crop to maize and sorghum, and again after hibernating. The writers have found that firing the winter quarters of the insect is the most economical and practical method of destroying it.

589 – ***Tomaspis flavilatera*, n. sp. (Hemiptera) on Sugar Cane in British Guiana** (1). — URICH, F. W. in *Bulletin of Entomological Research*, Vol. V, Part I, p. 43, figs. 1-2. London, April 1914.

The writer gives a technical description of a new froghopper, *Tomaspis flavilatera* (fam. Cercopidae), occurring on herbaceous plants and occasionally on sugar cane in British Guiana.

590 – ***Polychrosis botrana* and *Conchylis ambiguella* in Piedmont in 1913: Biology and Control.** — VOGLINO, P. in *Osservatorio consorziale di Fitopatologia in Torino. Osservazioni sulle tignole della vite eseguite nel Piemonte nel* 1913, pp. 35. Turin, 1914.

As the result of a conference between the Agricultural Committee of Turin and the Subalpine Vine-growers' Society, held on Febraury 22, 1913, a Commission was appointed to study the means of controlling the ravages of vine moths and to determine the value of tobacco extract for this purpose. The Commission met on the 1st of March and decided to appeal to local bodies and to the Ministry of Agriculture for financial help; the carrying out of the experimental work was entrusted to the Turin Phytopathological Observatory. (2).

Towards the end of April, measures were taken for the establishment of special stations for observation in various districts of the provinces of Turin (Moncalieri, Rivoli, Caluso), of Cuneo (Alba, Dogliani, Barolo), of Alessandria (Cassine, Mongardino) and of Novara (Briona). These

(1) See No. 352, *B.* Jan. 1911; No. 649, *B.* Feb. 1911; Nos. 1558 and 1584, *B.* May 1911; No. 1698, *B.* Dec. 1912; No. 1306, *B.* Nov. 1913, and No. 188, *B.* Feb. 1914. (*Ed.*).

(2) See article in *B.* July 1913, pp. 1000-1005. (*Ed.*).

stations were definitely established at the end of April and beginning of May. At each station one or two vines were planted in wire-netting cages, and a small meteorological observatory was erected. With a view to regulating the observations of the different stations, a special scheme of questions was drawn up, and a practical and scientific control was effected by means of special control cages of very fine wire-netting for rearing the insects, at the Observatory at Turin; periodic visits were made to the various stations and important vine-growing districts. Observations were also made in disttricts without special stations as follows: Acqui (province of Alessandria), Gattinara (province of Novara) and the Susa valley (province of Turin).

The results obtained in 1913 show that in Piedmont *Polychrosis* is more widely distributed than *Conchylis;* the latter was occasionally numerous (50-80 per cent.) in colder districts at the mouths of the mountain valleys (province of Turin), and was also frequent (50-65 per cent.) at Gattinara. In the true vine-growing districts exposed to the sun, in the provinces of Turin, Alessandria and Cuneo, *Conchylis* was found in proportions varying from 2 to 4 per cent., exceptionally 10 per cent.: the larvae and moths found were largely *Polychrosis*.

The development of *Polychrosis* is in direct relation to the humidity of the air, being favoured by damp; abnormal changes of temperature in the spring, which have an injurious effect on the growth of the vines, have little effect on the development of the insect. The damage was caused by the spring and summer generations; the autumn generation consisted of a limited number of moths, only occurring locally, which did not produce larvae until after the vintage was mostly finished.

The spring emergence of moths occurred throughout May both in the laboratory at Turin and at the several stations; in one station only (Rivoli) they continued to appear until the beginning of June, with a maximum during the second ten days of May. They lived from 13 to 15 days and deposited their eggs on the stalks of the bunches and the pedicels of the flowers, especially in the second half of May, but also in the first week in June. The larvae of the first generation appeared towards the end of May and pupated from the second ten-days of June until July.

The summer generation of moths first appeared at the Observatory station on the 26th of June, and at the Stations during the first few days of July, with a maximum emergence during the second ten days (14th to 22nd); they lived 11 to 14 days and began depositing eggs on the grapes about the 15th of July, continuing into early August. The larvae of the second generation appeared during the third ten-days of July and especially in August and began pupating at the end of August.

The autumn brood of moths only appered in certain districts (Mongardino, Dogliani, Barolo), from the 17th to the 22nd of September, shortly after the vintage. Only at Barolo was there supposed to be a third generation of larvae on the Nebiolo vine.

The season 1913 was not favourable to a biological study of *Polychrosis*, owing to the low humidity of the atmosphere, and the late spring frosts.

which in many places retarded the development of the shoots, thus depriving the moths of suitable places for depositing their eggs. Further researches are necessary to complete the biological study, especially with regard to pairing, oviposition, development of larvae of the second generation and the resistance of the pupae to insecticides and extreme temperatures.

The mode of cultivation has considerable influence on the development and spread of the pest. Where the canes or wooden supports are replaced by iron, sandstone or reinforced concrete, the number of insects is considerably reduced.

The programme for 1914 does not require an increase in the number of stations but an extension of regular and careful observations and the use of small cages made of fine wire netting and a sheet of mica. A certain number of pupae should be introduced into the cages in the spring and summer periods. By suspending these cages along the rows, it is easy to observe the first appearance of the moths and thus to regulate the application of insecticides. Cages are preferable to lamp-traps, since *Polychrosis* only flies at dusk.

Tobacco extract caused scorching in some places when used in 3 per cent. solution, but rarely in 2.5 per cent. solution, though combined with Bordeaux mixture ; a concentration of 2 to 2.5 per cent. was found to be most appropriate. It was not always effective in keeping the moths away from the vines, and in some places was hardly satisfactory for destroying the larvae, though in others two applications during the period indicated by the flight of the adults were completely effective. The addition of sodium carbonate (1 lb. in 100 gallons) to the tobacco extract (without Bordeaux mixture) increased its efficiency ; an intermittent jet should be used.

Tobacco dust damaged the vines in only two places, but was entirely without effect against the larvae.

Lead arsenate in 1 per cent. solution gave good results, combined with Bordeaux mixture, or used for dipping the young bunches.

The best results are obtained by employing arsenate of lead to destroy the first generation larvae, at least until tobacco extract can be obtained with a guaranteed nicotine content so as to avoid danger of damaging the young shoots. During July and August it is preferable to use tobacco extract (2 to 2.5 per cent.), since it acts as an insectifuge and avoids the difficulties of arsenate. The treatment should not continue later than the first few days of August, owing to the danger of affecting the flavour of the wine. In spraying, care should be taken to cover the neighbouring shoots with the liquid, since the moths kept away from the bunches would otherwise deposit their eggs on the leaves, and the larvae might reach the bunches.

In 1914 attention should be paid to clearing the vine stocks and removing hiding-places suitable for the hibernation of the pupae. On small holdings it would be useful to resort to hand picking of the larvae, without neglecting the use of insecticides.

The distribution of their natural enemies should be promoted by exposing during the winter badly attacked grapes in tubs covered with fine netting. Further, many pupae may be trapped by placing dark muslin or bunches of straw among the old wood of the vines.

591 – ***Agromyza pruinosa* (Diptera) on River Birch (*Betula nigra*) in America.** — GREENE, CHARLES T. in *Journal of Agricultural Research*, Vol. I, No. 6, pp. 471-474, plates LX-LXI. Washington, D-C., 1914.

The writer describes the different stages of development of *Agromyza pruinosa* Coq., the larva of which, unlike those of other species of *Agromyzidae*, bores into wood ; this species produces borings, known as " pith ray flecks ", in the cambium of the river birch (*Betula nigra*).

During July and part of August 1912 considerable damage was caused by this insect at Chain Bridge in the District of Columbia, whilst in 1913 it was only recorded on a few trees in this locality. The attacked trees appear quite healthy externally, the borings in the cambium being only visible on raising the bark.

The writer reared six adults of *A. pruinosa* during the spring of 1913 and found that it resembled very closely *A. carbonaria* Zett. which causes considerable damage to birches in Europe. He records *Sympha agromyzae* Rohwer, as parasitic on the eggs of *A. pruinosa*.

ALFREDO RUGGERI, gerente responsabile.

FIRST PART.

ORIGINAL ARTICLES

Root-Nodosities of Crosses between Swedes and Turnips

by

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The Danish Experimental Organization for Crops (1) has undertaken fairly exhaustive researches on crosses between swedes and turnips and the nodosities occurring on their roots. A short account of the information obtained may well be of general interest.

As is well known, swedes are derived from rape (*Brassica Napus*) and turnips from *Brassica campestris* (2). No nodosities form on the roots of crosses between two *Napus*-forms or two *campestris*-forms, but they occur when a *Napus*-form is crossed with a *campestris*-form, whichever be the female parent. If, for instance, the Bullock turnip is crossed with the Shepherd swede the offspring bear nodosities on their roots; but when Bullock is crossed with a summer *campestris*-rape or Shepherd vith a summer *Napus*-rape, no such formations occur, although Bullock and Shepherd are much more alike than *campestris*-rape and *Napus* rape. Both Bullock and Shepherd have round, thick, yellow-fleshed, green-topped roots; they are biennials with orange-yellow flowers. The two kinds of summer rape both have forked, woody and not fleshy, white roots, and are annuals with lemon-yellow flowers. Anyone not specially acquainted with the subject would be much more likely to expect root nodosities when such dissimilar plants as Bullock and *campestris*-rape or Shepherd and *Napus*-rape were crossed than when Bullock was crossed with Shepherd.

Notwithstanding the outward similarity of Bullock and Shepherd, there must be a decided inner difference between them, to judge by the antipathy exhibited in their sexual union; they show this by the appearance

(1) See article: « Organization of Field Experiments in Denmark, » by H. C. LARSEN, in *B.* Oct. 1913, pp. 1479-1483. (*Ed.*).

(2) There seems to be no English name to distinguish the *campestris*-rape (rübsen) from the *Napus*-rape (raps), so that the Latin names will be used here. (*Ed.*).

of the monstrous growths which we call " nodosities due to crossing" (Kreuzungsknoten).

The nodosities are of various forms according as the hybrid in question is rape-like, swede-like or turnip-like; they therefore merit separate description.

1) In the *rape-like hybrids* the nodosities are quite small, but are so closely crowded along the branches of the roots that they appear almost as swellings with small transverse wrinkles and folds reaching the whole length of the root (see Fig. 1). Occasionally hemispherical nodosities occur; these have the flat face towards the fork of the root (see Fig. 1, right). In rape-like hybrids the swellings predominate, nodosities, when present, being of secondary importance.

2) The *swede-like hybrids* are characterised by the size and abundance of the nodosities and the slight development of swellings. The nodosities occur on the bulb and on the fibrous roots, and vary from the size of hen's eggs to that of peas (Fig. 2, A); exceptionally, they may reach 4 to 6 in. in diameter (Fig. 2, B), and even form clusters, thus giving the bulb a more or less misshapen appearance (Fig. 2, C). The nodosities of these swede-like hybrids differ from those of the rape-like and turnip-like hybrids in being sharply defined and generally only joined to the bulb (Fig. 2, B) or the rootlet (Fig. 2, A) by small areas of union. The surface of the nodosities is very much wrinkled and uneven, something like the top of a cauliflower.

The rule mentioned above, that in swede-like hybrids nodosities are more abundant and swellings less so than in rape-like hybrids, is not true under all circumstances. The opposite is especially liable to occur in swede-like hybrids when the bulbs are unable to develop owing to the plants growing too thickly, to very late sowing or to other similar causes Thus, when conditions prevent the formation of the bulb, the swede-like hybrid resembles the rape-like one (Fig. 1) in its root-characters.

3) In *turnip-like hybrids* the nodosities generally appear as characteristic tumour-like bunches on the bulb itself (cf. Fig. 3, D, and Fig. 4, B and A) and are attached to it by large surfaces; they never occur on the fibrous roots. They are not wrinkled like those of the rape-like and turnip-like hybrids, but quite smooth and sometimes shining (Fig. 3, A and B).

As is shown in Fig. 3, A, large clusters of nodosities may occur in turnip-like as in swede-like hybrids (cf. Fig. 2, C). It will also be noted that the turnip-like hybrids are not behind the swede-like ones as regards the size of the nodosities; but they may be quite small as in Fig. 3, C, in which the bulb might pass for a typical Yellow Tankard but for the small nodosity on the middle of the left side.

The swellings at the places where the roots branch are even more characteristic in turnip-like than in rape-like hybrids, but are by no means so abundant. The roots on which they occur are disproportionately thickened throughout their whole length (see Fig. 4, C); as in the rape like hybrids these swollen parts are transversely furrowed. Sometimes these swollen side-roots are double (Fig. 4, C), apparently owing to the union of two rootlets throughout their length,

Among the turnip-like hybrids it is not uncommon to find plants like D in Fig. 4, in which the bulb has hardly developed at all, but is replaced by a number of short, much-swollen side roots.

Further attention should be drawn to the fact that turnip-like hybrids never produce a feature occasionally seen in the other two types, namely the occurrence of a certain number of adventitious shoots bearing rudimentary leaves arising from on or among the nodosities (see Fig. 5 and Fig. 2, D). Such shoots remain below ground and are consequently chlorotic throughout, unless they arise from roots at a very slight depth, when they may project to a maximum of 4 or 5 inches and become green.

As these nodosities occurring on hybrid swedes and turnips are liabl to confusion with those caused by the finger-and-toe organism (*Plasmodiophora Brassicae*), it may be well to describe briefly the means of distinguishing them. Fig. 6 shows on the left three plants of Fynische Bortfelder and on the right three of Bangholm's. The distinguishing characters of finger-and-toe disease are evident under the microscope, and in doubtful cases one may be obliged to have recourse to this method ; but as a rule a little practice serves to distinguish the two without difficulty. The first thing to be noted is the presence of characteristic spindle-shaped swellings on the side roots (see Fig. 6, A, B and C). In general shape they may somewhat resemble the swellings on the roots of turnip-like hybrids (cf. Fig. 4, C), but cannot be confused with them, as the surface of the finger-and-toe swellings is smooth and they never show the closely-placed constrictions so characteristic of the swellings on the roots of the hybrids. Though these swellings do not occur on every diseased root, they are sure to be found among a number of roots taken from a field where finger-and-toe is prevalent. Another distinguishing feature of the finger and-toe swellings is that they often show the beginning of cork formation on the upper part; this never takes place on the nodosities of hybrids. On the larger finger-and-toe swellings a considerable development of rough greyish-brown cork generally takes place ; the dark central part of Fig. 6, E, is a cork layer of this nature. Attention should also be drawn to the swellings near the tip of the root in Fig. 6, F; a swelling in that position fairly frequently occurs in both swedes and turnips attacked by the disease. In this case it differs from the nodosities of hybrids in narrowing equally above and below. Finally, a special characteristic of the deformed parts of roots attacked by finger-and-toe disease is the almost invariable presence of irregular brown streaks in the flesh, as may be readily seen on cutting the swellings across ; such streaks never occur in the nodosities or swellings due to hybridisation.

The elucidation of these points has been of considerable importance for the seed trade. To this work is due the fact that in the season 1913-14 the wholesale dealers in turnip seed were able to undertake to guarantee the trueness to variety and strain of the Danish swede and turnip seeds sold abroad, in conformity with the law of the 8th of June 1912 on penalties for erroneous designation of goods. This law gives the foreign purchaser the right to full compensation in case the crop grown from the Danish swede or turnip seeds contains so may hybrids or degenerated roots that the yield

is distinctly reduced. The fact that the Danish wholesale seedsmen have been able to assume without risk such a comprehensive liability for compensation is due to the demonstration by the Experimental Organization of the certain characters by which swede and turnip hybrids can be recognized. In careful selection of Danish strains of swedes and turnips carried out for a number of years, the seedsmen have thus been in a position to undertake such a thorough elimination of all plants tending to degeneracy that the stability of the strains may now be considered as thoroughly established.

Present State of Fruit Growing in Spain. (1) (The Principal Fruit Trees of the Rosaceae).

by

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Almost all the fruit trees grown in the different parts of the world grow in the open in Spain; from the chestnut woods which cover the northern slopes of the Cantabro-Asturian mountains to the plantations of bananas and guavas which adorn the orchards of Malaga and Cadiz, almost all kinds of fruit trees are well represented.

Limiting ourselves to the most widespread fruit trees, we shall consider pear and apple among hard fruit, and peach, apricot, plum and cherry among stone fruit.

Conditions and importance of fruit growing in Spain. — The Iberian Peninsula, covering seven degrees of latitude from the Straits of Gibraltar to the Cantabrian coast, and possessing various conditions of altitude, aspect, soil and geological formation, is very favourable for the growing of the above fruit. Indeed fruit is grown in all the 47 provinces on the mainland, and in some districts, such as Aragon and Rioja, it forms one of the chief sources of wealth.

The progress of fruit growing in Spain has been slow, on account of the former slowness and insufficiency of the means of transport. The development of the railways led to the spread of the use of fruit among all classes and to the extension of the plantations, though not to the same extent as in some other countries, nor in all the districts suitable for fruit.

Only meagre data on the fruit plantations of Spain and their production are available. According to the " Avance estadístico de la producción de frutales en 1910 ,, (Statistics of the production of fruit in 1910), published by the General Direction of Agriculture, Industry and Commerce, the total area under the above-mentioned kinds of fruit is 121 526 acres, distributed as shown in Table I.

(1) See also: JUAN M. PRIEGO, " The Present Condition of Citrus Growing in Spain ". — *B.* Feb. 1913, pp. 162-167.

Fig. 1. — Swellings and nodosities of rape-like hybrids.

Fig. 2. — Nodosities on roots of Swede-like hybrids.

Fig. 6. — Swedes and turnips attacked by *Plasmodiophora Brassicae*.

A B C D

Fig. 3. — Nodosities on roots of turnip-like hybrids.

C B

D A

Fig. 4. — Swellings and nodosities of Turnip-like hybrids.

Fig. 5. — Adventitions shoots on a rape-like hybrid.

TABLE I.

Acreage under hard and stone fruit in the various regions of Spain.

	Acreage under					
	Plums	Apricots	Peaches	Cherries	Pears	Apples
New Castile	1 163	479	329	739	1 050	1 055
Mancha and Estremadura	630	472	615	151	874	719
Old Castile	2 339	412	398	1 121	3 441	3 300
Aragon and Rioja	1 880	595	3 372	734	4 707	2 702
Leonesa	472	368	183	978	415	736
Galicia and Asturia	454	114	1 314	2 868	6 219	22 665
Navarre and Vascongadas	220	190	494	514	3 866	11 399
Catalonia	625	370	1 408	346	1 976	2 396
Levante	590	2 440	2 932	1 000	1 146	2 408
Eastern Andalusia	1 647	457	1 220	672	897	1 015
Western »	1 892	217	576	242	1 028	1 974
Balearic Isles	370	2 223	—	—	—	1 235
Canaries	99	123	173	—	642	442
Totals	12 382	8 462	13 012	9 364	26 261	52 045

The numbers in the Table are only approximate and leave out a large number of fruit trees scattered among other crops, or in gardens, vineyards and fields, since the precise valuation of the surface they occupy is very difficult.

The estimate of the amount of fruit produced is also below the reality. The fruit crop of 1910 was bad almost all over the country, owing to late frosts and summer drought. The 300 000 tons to which such produce approximately amounts, valued at the average price of 15 pesetas per quintal (11*s* 10 ½*d* per cwt.), which was the price adopted by the Commission appointed for the study of the transformation of the tax on consumption, give a value of nearly £ 1 800 000. In the work of the above Commission the value of the average crop of the fruit here considered was taken at £ 1 920 000, being based on older data as to the acreage under fruit.

The exportation is of no great importance, as may be seen from Table II.

If the data concerning the acreage under fruit trees, the yield and the exportation be compared with those of other countries under conditions similar to those of Spain, it will be seen that the latter is still far from having taken full advantage of its favourable conditions. Nevertheless its production is increasing, though not so rapidly as that of some other crops for which the country is less suitable. The land not devoted to field crops, such as much of that which is still uncultivated and a great part of the vineyards

TABLE II.

Exportation of hard and stone fruit from Spain, 1907-11.

	1907	1908	1909	1910	1911
	£	£	£	£	£
Apricots	2 338	200	478	3 832	1 26
Peaches	5 293	1 537	2 290	1 116	1 82
Apples	19 641	4 808	15 006	3 649	6 50
Plums	2 861	1 464	4 901	10 412	9 72
Other fresh fruit	25 578	24 089	30 757	27 795	23 84
Fruit pulp	36 841	32 330	37 533	63 298	60 14
Totals	152 552	64 428	90 965	110 102	103 31

destroyed by phylloxera, is eminently suitable to fruit growing. The market of the country are far from being amply provided, considering that the aver age amount consumed by the population is about 40 lbs., worth 2*s* 1½*d* per head per annum. Whole districts consider fruit as an article o luxury. The exportation of fruits is stationary and very limited ; England Germany, Denmark, Sweden and Russia hardly know the pears and peache of Aragon, Rioja and Lerida, the apricots of the Balearic Isles, Castelló and Murcia, and the cherries of Lugo, Orense, etc. France, whose consump tion of fruit per head of population is four times that of Spain, export fruit to the value of half a million sterling every year, and Belgium, whic is inferior in extent to two Spanish provinces, reaches nearly the same figure

Distribution of fruit in Spain. — Though fruit growing has not the sam importance in all the provinces, in all of them fruit trees are grown. Th various species are distributed as follows :

Hard fruit. — Pears and apples are cultivated almost throughou Spain. Table varieties have little or no importance in seven provinces, *viz* Leon, Cuenca, Malaga, Huelva, Valladolid, Guadalajara and Seville.

The most important plantations of *pears* are those of Aragon (basin of the Ebro, Jalon, Jiloca and Guadalope), Castellón de la Plana, Burgo (districts of Aranda), Galicia (Pontevedra, Orense and Lugo), the mount ainous districts of Andalusia, the Sierra de Córdoba and the territories o Baza and Guadix in the province of Granada. The first belt produces no less than 20 000 tons in average years; the pears are of such excellen quality that the Royal Household obtains its supplies from here. Th varieties most extensively grown are Sanjuaneras, Deagua, D. Guindo Bergamotas, and Roma ; these and some winter ones are exported i ever-increasing quantities into the South of France.

The area under dessert *apples* is very nearly the same as the above des cribed area. These apples, however, prevail in the Lerida district, ex tending also into the province of Gerona, in the Levante district, wher the summer and early autumn varieties thrive very well, and in the provinc of Cordoba (Cordoba, Baena and Cabra).

The cider varieties of both species cover the northern slopes of the Cantabrian mountains in the provinces of Navarre, Guipuzcoa, Biscay, Santander and Oviedo, and the slopes and valleys near the coast in the territory of Pontevedra and Lugo (Galicia). The province of Oviedo is the greatest producer of cider. The total crop of all this belt is from 8 to 11 million bushels of cider apples.

Stone fruit. — The most important stone fruit is the *peach,* both for the acreage devoted to it and for the value of the fruit produced. It is grown in 40 provinces, but its produce is really important only in those of Saragossa, Teruel, Logroño, Lerída, Barcelona, Orense, Murcia, Jaén and Castellón .The first four provinces form a belt in the basin of the Ebro and its tributaries, producing an average of about 4000 tons of excellent quality. The free-stone and Pavia peaches of Lerída, the clingstones of Sástago and Escatrón, the yellow peaches of Campiel, and the large peaches of Saragossa are equal or superior to the most esteemed of other countries and supply Madrid, Barcelona, etc., during the season, following the earlier ones from Castellón, Valencia and Murcia. Of all these peaches a certain proportion is exported to Paris, London and Hamburg.

The southern belt of the province of Madrid and its valleys of the Tagus and the Tajuña are rich in various fruits, including productive and highly esteemed peaches and plums. Its principal centre of production is Aranjuez which supplies a good deal of the fruit consumed in Madrid.

Under the form of "orejones" (peaches halved and dried), great quantities of the crop are prepared and preserved, as it would be difficult to export them fresh to great distances. The dried peaches of Malaga and Logroño are held in high esteem everywhere.

In point of importance the *plum* follows the peach. It is more regularly distributed, thanks to the greater resistance of its fruit to bad weather. Toledo, Granada, Almeria and Lerida rival Aragon in the production of plums. Greengages are, to a certain extent, exported to Paris and other capitals. In the Llobregat territory, plums are grown with apricots. They are also widely spread in the above-mentioned belt of the province of Córdoba, whence they are also exported to a certan extent. This productive tree, so reliable in its yield and having the advantage of producing fruit easily dried or preserved, deserves to be held in still greater consideration than it is.

Apricots, which are the most exacting as to climate of all the species here mentioned, naturally occupy the most limited area. At the same time they are grown in 36 of the provinces of Spain and are totally wanting only in the North and in a part of the North-west of the peninsula and in some provinces of Western Andalusia. The apricots of Toledo are distinguished by their keeping quality and resistance to carriage, due to the fact that they acquire a pleasant taste before they are quite ripe. The apricots of Levante are large, tasty and early. In Murcia they form part of the early produce exported to Central Europe. In the Balearic Islands they occupy about 2500 acres and give rise to an important export trade of fresh fruit and pulp for preserves; indeed they constitute the most valuable crop.

Egriots, morellos and *cherries* have been abandoned in a number of provinces; the central plateau of the two Castiles and the provinces of Salamanca, Lugo, Orense, Lerida and Castellón are the greatest producers of these fruits. Those grown along the Segre and the Cinca are profitably exported. The still earlier cherries of Sagunto and the Segures valley are packed in small boxes and sent to Paris. The large cherries, such as the Costalera, Corazón de Cabrito and some others with very firm flesh, being suited to extensive farming and possessing great resistance and keeping qualities, are especially advisable in the large bare plains and in the small ranges of Tertiary calcareous rocks so frequent in Spain.

Observations on cultural methods in Spain. — In almost all the above mentioned districts fruit trees are intermingled with other crops, chiefly in market gardens. In some districts, especially the Basque provinces, fruit trees are planted on grain land or pasture ; in some parts of Aragon and Levante they are grown in vineyards ; less frequently, as in the Toro neighbourhood, they form pure plantations.

The drawbacks of intermingled crops, especially of trees with field crops, are well known. The former cast an injurious shade on the latter and these in their turn take up much moisture and plant food from the soil. Manures to suit all the different plants cannot be prepared, and the operations of tillage and irrigation do not always coincide. This interplanting of fruit trees with other crops, which is so frequent in Spain is, we believe, one of the chief causes of the fact that fruit growing is not so profitable as it might be. The farmer devotes more care to the garden crops, the cultivation of which he generally knows better, whilst he is ignorant of the practice of treating and pruning the fruit trees.

In these various types of fruit plantations the different kinds of trees are generally mixed together. But besides these plantations there are many scattered trees, chiefly apricots and plums, in either enclosed or open fields.

Economic data. — Yield of fruit trees in Spain. — If the returns of fruit growing were to be estimated upon the figures supplied by the " Avance " of the General Direction of Agriculture, to which we have already referred, the conclusions would not be very favourable. The figures are the following :

	Yield per acre — cwt.
Pears	51
Apples	58
Peaches	30
Plums	43
Apricots	40
Cherries	40

But, as we have already said, the 1910 crop was generally bad and these yields are certainly inferior to the average. The data collected by us in the chief producing centres are the following :

Pears. — Standard pears begin to produce at the age of 15 years. When in full bearing they yield about 1 cwt. of fruit per tree. The value

of this fruit varies, like that of all other kinds, with the variety and the season. Those produced in Aragon, sold on the spot under normal conditions, may be valued at 8*s* per cwt. A certain proportion of the good autumn and winter varieties are exported and fetch more than double the above price. In the province of Saragossa the variety most esteemed for exportation is the De Roma. In a regular plantation in rows about 100 pear trees are grown to the acre ; they yield about 5 tons of fruit, worth about £40.

Apples. — The bearing and yield of apples vary still more than in the case of pears. We believe that the figures of the above " Avance " may be taken as correct for average years. The apples supplied to the Madrid market come for the most part from the Valenza and Teruel districts, where their price ranges between 6*s* and 12*s* per cwt.

Peaches. — Peach trees begin to bear at the age of four or five years. Their average yield may be taken at 44 lbs., and as in one acre there are about 120 trees, the yield per acre is about 47 cwt. of fruit ; in normal seasons this is worth, at the orchard, never less than 12*s* per cwt., the gross returns being thus about £28 per acre. Peaches are the most esteemed fruit, even in the home market ; especially choice and early fruit fetches high prices. They are frequently sold by the dozen, and on the spot where they are grown the large peaches of Saragossa and Lerida, or early or late varieties, command as much as 1*s* 7*d* per doz. The peaches of the Segre, Cinca and Llobregat valleys supply Barcelona, and some are shipped from that port. A certain amount of exportation takes place from Castellón de la Plana. The peaches of Saragossa, Teruel and Rioja are consumed in the interior or used in the local preserve factories.

Plums. — This tree is grown almost always as a standard and develops well in the whole of Spain, producing, when fully grown, as much as 130 lbs. of fruit per tree. Of all the fruit trees it is the one least frequently grown by itself. The price of its fruit varies very much; its dimensions, form, colour, taste and keeping qualities (the latter never being high) also differ largely in the different varieties. In years of abundance their price falls as low as 2*s* 5*d* per cwt. Greengages, when well packed, are worth eight or ten times as much on the great markets.

Señor GAJON, a well-known fruit grower of Saragossa, calculates the yield of a plum tree as follows: 10*d* at the age of six years ; 6*s* 4*d* at twelve years ; 9*s* 6*d* at sixteen ; 11*s* 10*d* to 15*s* 10*d* at twenty and upwards, always provided that the fruit be placed on a good market.

Apricots. — The yield of this tree, which is never very regular, may be valued at 132 lbs. per tree every other year. Reckoning 112 trees per acre (real distance apart about 20 feet), the average produce per acre per annum would be about 66 cwt., which, at a minimum price of about 10*s* per cwt., amounts to an average gross income of £33 per acre.

The plantations of Murcia, Aranjuez and Toledo supply the Madrid market ; Castellón and the Llobregat valley that of Barcelona. These districts and Murcia export a good number of boxes. This fruit has acquired considerable importance in the island of Majorca, where it now occupies

about 2250 acres and is yearly extending. The apricot preserve exported every year from the Balearic Islands is valued at £24 000.

Cherries. — The produce of this tree, which is more reliable than that of the apricot, is estimated at 330 lbs. per tree; the fruit of good varieties sells at 8*s* to 12*s* per cwt. Where the cherry trees attain their full development not more than 40 can be planted to the acre, in which case the gross returns may be estimated at least at £40 per acre.

The first cherries to appear on the Paris market are from Spain. Unfortunately the number of boxes exported is limited, as the production barely keeps pace with the home consumption and it is difficult to understand why a fruit that is in such demand both at home and abroad is not more widely planted.

Cost of production. — The cost of producing fruit varies very much according to the locality and the systems of cultivation adopted; the difficulty of ascertaining such cost is greater when the fruit trees are interplanted with other crops. When they are grown by themselves, the cost of production is but little higher than that of growing olives. There is no doubt, however, that they leave the grower a satisfactory margin of profit and that fruit growing is destined to develop considerably in the near future.

The Dairy Industry in Italy at the Present Time

by

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Statistical data on milk production.

No accurate and recent statistics on milk production in Italy are available, and the data given in the present paper have been obtained indirectly or are merely personal estimates. The last live stock census, taken in 1908 by order of the Department of Agriculture, forms a positive point of departure; from it are taken the following figures dealing with the classes of animals producing milk:

	Number of head
Sheep	11 162 926
Cattle	6 198 861
Goats	2 714 878
Buffaloes	19 366

The dairy industry depends chiefly on sheep and cattle. The scarcity of the bovine species, which is the more important in milk production, is quite evident both when the numbers are considered in relation to the number of inhabitants, or when compared to various other European states. With regard to the distribution of the cattle over the twelve regions of Italy,

more than half the total numbers, or 3 662 813 head, are found in the valley of the Po, and of these over one million are in Lombardy, where the density of cattle is at its maximum; Emilia, Veneto, Piedmont and Sardinia follow in the order given at no great distance apart. Lower Lombardy, which includes the fertile irrigated plains of Pavia, Milan, Cremona, Brescia, Mantova, is the zone of most intensive milk production. Owing to irrigation, four crops of hay may be obtained annually, and on the so-called " marcita " fields, near Milan and Pavia, the number rises to seven or eight. The quadrangle bounded by the rivers Ticino, Po and Adda and the parallel running through Milan is characterised by its dairy farming, the milk production per unit area or per head of the population being higher than in any other part of the world. Emilia too, in the provinces of Reggio, Parma and Modena, has made great strides since 1881 with regard to increasing the number of its cattle, its forage crops and its milk production, so that to-day the density of cattle for the whole region (Emilia) is higher than that of any other whole region in Italy, *viz.* 18.1 per square mile. In fact the number of cattle increased in all parts of Italy from 1881 to 1908, the total increase being almost one and a half million head, or about 30 per cent., and its quality has improved at the same time.

Sheep are most abundant in the southern Adriatic region, where about two million head are found, while the southern Mediterranean region, Sardinia, Latium, and Tuscany follow in order, having over a million head each. The density is highest in Latium. In a general way it may be said that the number of cattle per acre decreases going from north to south while on the contrary the number of sheep per acre increases. Goats abound in the southern Adriatic region but in no other parts. Buffaloes are pastured on swampy ground where no other domestic animal could live; herds are found in certain localities in Latium and in the southern parts of the country (Salerno, Caserta, Foggia, etc.)

As the 1908 census does not state the number of females which may be considered milking stock in each of the above classes of live stock, an approximate estimate must be made to arrive at the milk production in Italy. Assuming that the percentage of milking stock in the total registered be 60, 70, 55, and 50 for cattle, sheep, goats and buffaloes respectively, then the numbers of milking stock in Italy would be approximately as follows:

Cows	3 600 000	head
Sheep	7 800 000	»
Goats	1 500 000	»
Buffaloes	10 000	»

It is not easy to calculate the average quantity of milk produced by the above stock, owing to the heterogeneousness of the breeds and to the dissimilarity of systems of management.

Cow's milk. — Leaving aside the question of breeds, there are two opposite systems of management of milch cows in Italy, *viz.*: permanent housing and free ranging. In the north, where milk is an important industrial

substance, the cows are housed permanently or almost permanently ; thi system is also in vogue in parts of Central Italy (Tuscany, Umbria), wher however, the milk is chiefly used for calf rearing. Free ranging is met wit in the central regions beginning in Latium, in the southern part of th country and in the islands, where the milk is partly employed for cal rearing and partly for cheese making on a small scale. In the latter cas yields are small owing to the not infrequent scarcity of fodder and to th exposure of the cattle.

Where milk production is carried on intensively, as for instance i Lombardy, calves are usually removed from their mothers a few days afte birth and almost the entire production of milk is available for cheese making In the central regions, on the contrary, the cows are never milked, bu merely suckle the calves, in which case the period of lactation is greatl reduced. An intermediate system exists in Sardinia, where it is usual t milk the cows once a day during a part of their lactation period, *i. e.* durin April, May, June, and October.

To estimate the average production of milking cows in Italy, thos which are only used for suckling calves and those which are only milke for a very brief period should be excluded, *i. e.* about 1 000 000 head, whic reduces the number of milking cattle from 3 600 000 to 2 600 000 The average annual production per head varies from 25 hectolitre (550 gallons) in Lombardy to 10 hectolitres (220 gallons) for Alpine cattle an 4 hectolitres (90 gallons) for free ranging cattle in Sardinia, so that assumin an average production of 12 hectolitres (265 gallons) for the above 2 600 00 cows the estimate will be conservative. On this basis 31 200 000 hectolitre (7 million gallons approx.) would be produced annually, of which part i used for direct consumption and part is worked up into other dairy produce

The population of Italy, consisting of 34 million inhabitants, consume very little cow's milk, the consumption being highest in the northern prov inces and least in the central and southern regions, where many Italian never drink cow's milk at all, partly because it is not customary to do so an the product is expensive, and partly because they use ewe's or goat's mil instead. The average consumption per head may be estimated at 18 litre (4 gallons) per annum, or 0.05 litre (0.1 pint) per day, which is a negligibl quantity compared with the consumption in Germany, Denmark, Holland Sweden and Norway. On this basis 6 120 000 hectolitres (150 millio gallons) are consumed directly, leaving 25 080 000 hectolitres (550 millio gallons) for the production of other dairy products.

Ewe's Milk. — The milk production of ewes varies from 100 litr (22 gallons) per annum in Sardinia to 40 litres (10 gallons) in some of th flocks on the mainland. Assuming a mean yield of 70 litres (15 gallons) p head per annum, the annual production of ewe's milk available for th dairy industry is 5 460 000 hectolitres (120 million gallons).

Goat's Milk. — Goats yield more milk per head than do ewes. In Sa dinia their annual yield is estimated as 140 litres (30 gallons), but f present purposes 100 litres may be taken as the average figure per he

after deducting the amount required for raising the kids. This is equal to a total annual production of 1 500 000 hectolitres (33 million gallons).

Buffalo's Milk. — Milking buffaloes may yield from 5 to 8 hectolitres (100 to 180 gallons) per annum, but the semi-wild state in which they are kept causes their milk yield to vary considerably from year to year. For present purposes their yield may be estimated at 4.5 hectolitres (100 gallons), which gives a total annual production of 45 000 hectolitres (1 million gallons).

The following table summarises the data dealing with the milk production of the bovine and ovine species, this being not only the most important source of supply but also the one capable of eventual increase.

	Cattle	Sheep
Total numbers (1908 census)	6 198 861	11 162 926
Females	3 600 000	7 882 727
Milking animals	2 600 000	7 800 000
Average yield per head . . . . . galls.	265	15
Total annual production . . . . . million galls.	700	120
Milk used for direct human consumption » »	150	—
Milk worked up industrially . . . . » »	550	120

It is important to emphasize the fact again that of the above figures, only those of the 1908 census are absolute, the others being the result of estimates.

Utilization of Milk.

Cow's milk. — This is put to three chief uses:

1. Condensation. — Carried out in two factories in Lombardy; only accounts for a very small proportion of the total produce. Milk powder is also prepared in small quantities.

2. Direct human consumption. — City dairies, which deal with this section of the industry, are to be found in the principal Italian cities, but even the most modern and up-to-date examples are very modest compared with the large establishments of this kind which exist in other countries, such as at Vienna and Berlin. Much improvement has taken place with regard to the handling of milk, but even now the greater part is sold by small local dealers. The retail price consequently varies with the abundance of the local production, and prices increase from North to South of the country, the minimum and maximum being 2*d* and 6 ½*d* a quart respectively. Of late years prices have tended to rise. The wholesale prices obtained in Lombardy and Emilia have risen gradually from 5*d* to 7.7*d* per gallon during the last ten years. In all the principal cities, the retail milk trade is subject to inspection by local hygiene officers.

3. Cheesemaking. — About five-sixths of the total milk production is turned into cheese, butter, and their bye-products. The factories dealing with this section of the industry may be grouped into three classes: private factories, where the producer of the milk turns it into cheese and butter

himself; industrial factories, such as exist in Lower Lombardy, where the milk is bought from the producers and worked up—as much as 4 400 gallons being dealt with per day; and cooperative factories, which are chiefly to be found in the Alpine districts, but which also exist in Emilia, while a few isolated examples may be found in Sardinia and in the South. The number of these cooperative factories fluctuates considerably, as new ones are started every year while others close down. They are most numerous in the province of Udine, where they number several hundreds, while the total number in the country must amount to almost a thousand. The most modern example and the one which deals with the largest quantity of milk is that at Soresina (Cremona prov.).

Cow's milk cheeses. — These are of three kinds:

1. Moulded cheeses—such as Stracchino, Gorgonzola, Robiole, Fresa.

2. Hard cheeses — Grana (including Parmesan, etc.) Fontina, Bitto, Asino, Montasio, Bra; the skim milk (so-called Swedish) cheeses; "Margarinati" cheeses (in which butter fat is wholly or partially substituted by margarine); and the Swiss cheeses, Emmenthal, Gruyere.

3. Soft cheeses - whose name alters with their shape: Caciocavallo, Provolone, Scamorza, etc. Ricotta, a white curd sold in Italian cities, is usually a bye-product obtained from whey, but may also be prepared from fresh milk.

Stracchino and Gorgonzola are chiefly produced in Lombardy and to a slight extent in the adjoining plains of Piedmont; Fresa is a Sardinian speciality; grana comes from Milan, Southern Lombardy and Northern Emilia; Fontina and Bitto from the Alps to the west and north; Asino from Vicenza; Montasio from Udine, and Bra from Piedmont. Swiss cheeses are made in Lower Lombardy and the soft cheeses which used to be a speciality of the Abruzzi, Latium and the South are now also being manufactured in the North.

Butter is chiefly produced in Lombardy, either in the cheese factories or in special creameries; appreciable quantities also come from Veneto, Piedmont and Emilia. In certain southern provinces butter-fat is enclosed in a kind of bag made of soft, elastic curd, the whole being called "manteca".

With regard to bye-products, lactose is only prepared by a very few factories; the extraction of casein is rather more general, and is supplanting the manufacture of skim-milk cheeses, which is no longer remunerative on account of over production. Other bye-products are "vituline", a kind of calf meal, and dairy waste, which is used for pig feeding.

Ewe's Milk Cheeses. — This group of products has developed considerably of late years owing to their growing importance in the country's exports, and flocks are in consequence receiving more attention. The type of cheese varies from place to place, as a considerable proportion is still made for local consumption; the following may be mentioned as typical examples: Pecorino Romano, Cotronese, Moliterno, Pecorino Sardo, Cacio fiore, Incanestrato di Sicilia. Of these, the Pecorino has acquired commercial importance during the last twenty years. It originated in Latium, which is still the centre of production, but its manufacture has been considerably

extended in Sardinia, where up-to-date cheese factories have now been erected for the purpose.

Goat's Milk Cheeses. — These are small and only made for local consumption. Goat's milk is frequently mixed with cow's milk or ewe's milk to form so-called " mixed cheeses ".

Buffalo's Milk Cheeses. — Small, round, soft cheeses are made with buffalo's milk, which is rich in fat. These are somewhat sweet with a pronounced flavour and find a market in the southern towns where they are sold under the names of: mozzarelle, uova di bufala, provole, provature.

Value and amount of cheese produced.

In estimating the amount of cheese produced, it is assumed that:

cow's	milk	yields	7	per cent.	of cheese
ewe's	»	»	15	»	»
goat's	»	»	10	»	»
buffalo's	»	»	20	»	»

After deducting from the cow's milk the amount used for butter-making, the annual production of which is estimated at about 50 000 tons, the amount available for cheese making is reduced to 23 000 000 hectolitres (505 million gallons). The production of cheese is, therefore, as follows:

cow's milk	16 100	tons
ewe's »	8 100	»
goat's »	1 500	»
buffalo's »	90	»
total	25 790	tons

To obtain the value of the total produce, butter and cheese are taken at the wholesale prices of 260 lire per quintal (11.8*d* per lb.) and 160 lire (7.3*d* per lb.) respectively as follows:

	annual value	
butter	£	5 200 000
cheese	»	16 505 000
bye-products	»	640 000
total	£	22 345 000

Foreign Trade.

Exports. — According to statistics published by the Ministry of Finance, exports of dairy products in 1913 were as follows:

	Amount tons	Value £
Fresh or sterilized milk	226	18 108
Fresh, sterilized and peptonised cream	0.75	528
Condensed milk, unsweetened	8	3 620
» » sweetened	251	120 588
Fresh butter	242	286 656
Salted butter	30	35 032
Cheese, Grana	916	916 480
» Swiss	94	79 084
» Pecorino	917	880 896
» Caciocavallo	211	227 748
» other hard types	155	148 808
» Gorgonzola, Stracchino	916	696 324
» other moulded types	7	4 916
Total		3 418 788

It will be seen from the above table that the largest exports consist of Grana, Pecorino and Gorgonzola cheese. The principal importing country is the United States, followed by Argentina, the cheese being consumed there by the large Italian immigrant population. Gorgonzola, however, goes chiefly to England, France and Switzerland.

Exports of cheese, have increased steadily since 1871, as shown by the following figures :

Year	Exports tons
1871	176
1879	266
1883	383
1887	503
1894	722
1899	1 043
1902	1 308
1906	1 919
1907	2 114
1911	2 785
1912	3 062
1913	3 277

Exports previously consisted almost exclusively of Grana, but both the amount and the number of kinds exported have now largely increased.

Imports. — A little butter and a considerable amount of cheese (about one-sixth of the export value) are imported annually, the imports for 1913 being :

Butter	40	tons
Swiss cheese	450	»
Other hard cheese	97	»
Soft cheese	12	»
Total annual cheese imports	559	»

valued at £549 868.

The cheeses mostly come from Switzerland; other hard cheeses are mostly Pecorino from the Levant. Imports were at their highest in 1887, when they reached 1235 tons; then they decreased rapidly and remained practically stationary at 450 tons until 1913.

SECOND PART.

ABSTRACTS

AGRICULTURAL INTELLIGENCE

GENERAL INFORMATION.

AGRICULTURAL EDUCATION

592 – **Agricultural Education in South Africa.** — *Journal of the African Society*, Vol. XIII, No. 51, pp 288-295. London and New York, April 1914.

Agricultural education in South Africa is controlled by the Union Department of Agriculture, and under this head are embraced the activities of four Schools of Agriculture with Experiment Farms, eight Experiment Stations, and four Stud Farms, also a Household Science branch. For the better administration of these Institutions, a separate division of the Department was recently created, under the control of one of the Under Secretaries. There exist, in addition, Experiment Stations connected with the work of the Tobacco, Cotton, Horticultural and Botanical Divisions, but these are directly under the control of the Chiefs of these Divisions.

The annual vote for agricultural education, inclusive of salaries, general maintenance, and development, amounts to about £120 000, but this amount does not include grants through loan funds or votes on the Public Works Department's estimates for buildings. During the current year these amounted to no less than £60 000.

The principal schools are:

A. *Cape Province:*

1. ELSENBURG, the oldest established of the Schools, with between thirty and forty students, is situated about thirty miles from Cape Town. Area of station 1 700 acres. Special features at this institution are horticulture, viticulture, wine-making, cereals and tobacco (Turkish).

2. GROOTFONTEIN, outside the town of Middelburg (Cape) with about eighty-five students. Area of station 25 000 acres. Special features at Grootfontein are agriculture (including irrigation under Karroo conditions), ostriches, Merino sheep and Angora goats.

B. *Transvaal Province:*

POTCHEFSTROOM, about eighty-three miles to the southwest of Johannesburg, with about sixty-five students. Area of station 4 000 acres. Spe-

cial features of the instruction are agriculture representative of High-Veldt conditions, cultivation of crops under irrigation and otherwise, cattle, maize and other cereals.

Natal Province :

CEDARA, fourteen miles to the north of Maritzburg. The station covers about 3 600 acres, and has some thirty students. Special features are sub-tropical agriculture, forestry (including wattle growing), cattle and maize.

Orange Free State Province :

There is no similar institution at present, but one is in course of establishment at Glen, near Bloemfontein. Arrangements have been made to receive students in 1915. A farm was purchased for the purpose at a cost of £20 000, and £40 000 has been provided on "loan funds" for the erection of the necessary buildings.

593 – **Technical Organization in German East Africa.** — *Deutsches Kolonialblatt*, Year XXV, No. 2, pp. 66-67. Berlin, January 15, 1914.

The following information has been received concerning the projected technical organization in German East Africa and the foundation of a native school for training practical mechanics at Daressalam :

The "Kolonial Wirtschaftliche Komitee" proposes opening three technical bureaus in the colony at Daressalam, Tanga and Lindi. These will be placed under the direction of competent certified engineers who have already had much experience in the colonies and will act as central consulting bureaus on all technical matters. The engineers will visit existing machinery on the plantations, advise, suggest improvements, etc. No fees will be charged for consultation other than the travelling expenses of the engineers.

At the same time a school for training practical native mechanics will be erected at Daressalam. The Committee have already rented a plot of land (23 680 square feet) from the Government up to October 1, 1919. The cost of building the school and its working expenses for the years 1914, 1915 and 1916 will be defrayed by funds voted by the metal and machine industry. The Government has already declared itself willing to instruct its officials in the different localities of the colony to select the most promising youths for instruction and to send them to the school. The number of pupils is at present limited to thirty.

The objects of the school are the following ;

1. To train native mechanics and engine drivers. Only youths who have had some preliminary education and who are accustomed to working will be admitted. As encouragement they will get regular pay as soon as they enter the school.

2. To provide the railways, mines, internal navigation companies, factories and plantations in the colony with cheap technical labour, and, in time, to supply other German colonies also.

3. To act as an experiment station where German machines and implements will be tested and compared with foreign ones. People in the colony who are interested in machinery will be invited to attend the tests in order

to encourage useful discussions, and the Government will also be represented.

The education given in the school will be chiefly of a practical nature and will be adapted to the character of the natives. The first course will consist in rendering them familiar with all smiths', mechanics' and fitters' work, with the management of agricultural machinery and with the carrying out of all sorts of repairs. The second course will be more specially devoted to rendering the pupils capable of managing engines of all kinds, *i. e.* steam ploughs, machinery for hemp, cotton, rubber, etc., motor cars and boats and their repairs.

The machines and implements of the permanent exhibition will be included among the material available for the school. At the examinations held at the end of the course a Government commission will be present.

The chief stimulus to the foundation of the above school has been the scarcity of people capable of managing the cotton harvesting and other machines needed in the colony — a want which has hitherto been a serious handicap and prevented the extended use of machinery.

ORGANIZATION OF EXPERIMENTAL AND ANALYTICAL WORK.

594 – The New Standards adopted in Germany for the Trade in Sugar-Beet and Mangel Seeds. — EDLER, W. in *Fühlings Landwirtschaftliche Zeitung*, Year 63, Part 8, pp. 268-277. Stuttgart, April 15, 1914.

Owing to the difficulties which have arisen from alterations of the so-called Magdeburg standards, formerly universally recognized in the German beet-seed trade, the interested parties have drawn up a new set of rules. These differ from the earlier ones in that mangel and sugar-beet seeds are treated separately ; further, instructions for the taking of samples and for the calculation of the deduction to be made on seeds not coming up to standard, but yet saleable, have been added.

German standards for the trade in sugar-beet seeds (1914).

The following bodies have taken part in the drawing up of the clauses given below : Ausschuss für Handelsgebräuche (representing the Deutscher Landwirtschaftsrat, Deutsche Landwirtschafts-Geselleschaft, Bund der Landwirte, Reichsverband der deutschen landwirtschaftlichen Genossenschaften für Deutschland and Vereinigung der deutschen christlichen Bauervereine), Verein der Deutschen Zuckerindustrie (Crude-sugar factory section) and the Gesellschaft zur Förderung deutscher Pflanzenzucht. These are valid where no other agreements are in force.

§ 1. — The sugar-beet seed should be delivered in good condition, fit for use, and, except for the screening necessary in cleaning, not graded according to the size of the clusters. The seed must belong to the variety named and must agree with the particulars of the other paragraphs.

§ 2. — The seed should contain at least 85 per cent. of dry matter (15 per cent. moisture). It is saleable with the dry matter down to 83 (17 per cent. moisture), but in that case the difference must be allowed for in the price (formula, § 5).

§ 3. — The purity should be at least 96 per cent (pure seeds after subtraction of impurities including clusters passing through a 2 mm., = 0.08 in., sieve). Seed is saleable down to 94.5 per cent., but the difference must be made up (formula, § 5).

§ 4. — One kilogram (2.2 lbs.) of seed must give in 14 days a minimum of seedlings as follows :

a) large-cluster seed	60 000
b) medium-cluster seed	65 000
c) small-cluster seed	70 000

Of this number, 70 per cent. must be up in 7 days.

One hundred clusters must give in 14 days a minimum of seedlings as follows :

a) large-cluster seed	80
b) medium-cluster seed , ...	75
c) small-cluster seed	70

Large-cluster seed is reckoned as containing not more than 40 clusters to the gram, medium-cluster 41 to 50, and small-cluster 51 or more.

§ 5. — Seed not fulfilling the conditions of §§ 1-4 is not saleable.

If the price is to be reduced under *either* § 2 *or* § 3, the reduced price is obtained by the following formula :

$$\frac{\text{price agreed upon} \times \text{value of seed delivered}}{\text{guaranteed value}};$$

but if *both* § 2 *and* § 3 require a reduction, the price is obtained by the formula:

$$\frac{\text{price agreed upon} \times \text{actual dry matter} \times \text{actual purity}}{85 \times 96.}$$

§ 6. — In the absence of any other agreement, samples must be taken within three days of the delivery of the goods, and by a sworn sampler. The directions for sampling are given in the appendix.

§ 7. — The determination of the conformity to agreement of the seed delivered is made by a station belonging to the Union of Agricultural Experiment Stations of the German Empire (Verband landw. Versuchsstationen im Deutschen Reiche) according to the method prescribed by this Union.

Each of the parties has the right to stipulate that the examination be made by a particular station belonging to the Union. The average of the two results is taken. Either party may also require a decisive analysis ; no reasons need be given for this, but notice must be sent in within four days of the receipt of the first results ; such analysis is to be made by a third station, selected by agreement or by drawing lots. In the demand for the decisive analysis it must be stated which determination is to be remade. In this case the average of the decisive analysis and the one which comes near-

est it on the disputed point is taken ; if the decisive analysis is half way between the other two, it is accepted.

Each party pays for his own original analysis, while the decisive analysis is paid for by the party requiring it.

§ 8. — If the presence of foreign beets, such as mangels, in the seed is complained of, a cultivation experiment is to be carried out in the same or the following year, using a certified seed sample. This is to be entrusted to an experiment station selected as for the decisive analysis. Each party may send an expert to judge of the result ; the director of the station fixes the day for this and acts as umpire.

Appendix. — Directions for sampling sugar-beet seeds.

1. *Taking the sample.* — Samples must only be taken from unopened consignments in sacks ; these must be so arranged that their number can be counted, or, if they are piled up, fairly accurately estimated. The lots must also be labelled in such a way that no doubt can arise as to their identity.

If the lot numbers more than 100 sacks, a sample must be taken from at least every twentieth sack ; if there are between 20 and 100 every tenth must be sampled, while for fewer than 20 sacks half must be sampled.

The sampler chooses the sacks from which he wishes to take samples ; these should be well distributed through the lot ; further the different samples should come from different parts of the sacks, and for this purpose he may have a certain number of the sacks emptied. At the request of one of the parties concerned, all the sacks to be sampled may be turned out. If, for want of room or other reasons, it is not practicable to empty the sacks, this fact must be noted in the report. The use of a sample bore is only allowed provided there is no possibility of its damaging the seed.

The sampler must be provided with the necessary labour for the work of sampling.

Sampling in a railway truck is allowable ; the same directions apply in this case.

2. *Treatment of the sample.* — The average sample made up from the small portions is thoroughly mixed and then divided into separate samples according to the number of analyses required.

The samples for the determination of moisture and purity are to be enclosed in clean and dry air-tight vessels of glass or tin ; the openings are then to be sealed with sealing-wax, rubber, wax or some similar substance; ground-glass stoppers should be greased. The samples must be tightly pressed into the glasses or tins. Each sample must weigh at least 200 gms. (7 oz.).

The samples for the determination of germination capacity are to be preserved in cloth bags or double paper bags ; they may not be enclosed in air-tight vessels. Each of these samples must weight at least 200 gms. (7 oz.).

The samples must be sealed or leaded by the party or parties present in such a way it that is impossible to open them without damaging the cover-

ing. When the samples are sealed, the sampler must label them ; for tins a properly adhesive sealed paper label is used, for bags a tie-on label ; in either case he must write on it the reference number from his diary, place and date of sampling, brand and number of the sacks making up the lot, name of the purveyor or receiver (even supposing him to be only temporarily in possession of the seed), and the apparent nature of the packing ; this information he certifies by his signature. If the sample is taken in a railway truck, the number of the truck must also be entered on the label.

If required, the sampler must provide a duplicate copy of this label, describing the nature and appearance of the seal or lead.

The sampler must see to the provision of the implements and materials necessary for the sampling.

3. *Number and destination of the prepared samples.* — The sampler has to prepare, according to instructions, 4 or 5 samples in glass vessels or tins and the same number in cloth or paper bags. He must send off those required within twenty-four hours to the addresses furnished by the person under whose instructions he is proceeding. He must also send one duplicate sample each to the purchaser and the vendor, while one he keeps himself.

The samples should be kept in dry unheated rooms. The sampler must keep his sample for a whole year, and must not part with it or deposit it for judgment except on the combined demand of vendor, purchaser, committer and receiver.

A duplicate copy of the label should be given to the temporary possessor, provided he is not the committer.

If the interested parties require it, the sampler may make more than the 4 or 5 samples, in return for a proportionate fee, but these must only bear his seal.

4. *Obstacles to sampling.* — If the sampler finds himself unable to observe these instructions, he must abandon the sampling.

German standards for the trade in mangel seeds (1914).

The following bodies have taken part in the drawing up of the clauses given below : Ausschuss für Handelsgebrauche (representing the societies named above), Gesellschaft zur Förderung deutschen Pflanzenzucht, and Vereinigung der Samenhändler Deutschlands. These are valid where no other agreements are in force.

§ 1. — The mangel seed must be delivered in good condition and fit for use ; it must belong to the variety named and must agree with the particulars of the other paragraphs.

§ 2. — As for sugar-beet seed.

§ 3. — As for sugar-beet seed, except that purity as low as 94 per ent. is allowed.

§ 4. — One kilogram (2.2 lbs.) of seed must give in 14 days a minimum f 60 000 seedlings. Of this number, 42 000 must be up in 7 days. The eed is saleable with only 50 000 seedlings per kilo, but the deficit below o 000 must be allowed for in the price.

One hundred clusters should give in 14 days a minimum of 75 seedlings for large-cluster seed and 70 for small-cluster seed. The seed is saleable with these figures down to 70 and 65, but the deficit must be made good. Large-cluster seed is reckoned as containing not more than 45 clusters to the gram of pure seed, small-cluster 46 or more.

In calculating reduction of price, an excess or deficit of seedlings per kilo may be set against a deficit or excess of germinating clusters, but the minimum value must come up to the standard. At the same time no raising of price is allowable. For the calculation of the reduction of price the formulae given in the Appendix are to be used.

§ 5. — Seed not fulfilling the conditions of §§ 1-4 is not saleable.

§ 6. — As for sugar-beet seed.

§ 7. — Differs from that for sugar-beet seed in that the station to make the decisive analysis is not to be selected by drawing lots ; if the parties cannot agree within eight days, the president of the Deutscher Landwirtschaftsrat nominates a station belonging to the Union. Further, in case of delivery contrary to agreement the vendor bears all the costs of analysis.

§ 8. — If the purchaser considers the colour (within the variety) of importance, he may propose a determination of this by germination tests ; any complaint on this point must be made within eight days of the receipt of the examination certificate. If complaint is made as to the correctness or purity of the variety, a cultivation experiment made in the same or the following year, using a certified seed sample, is to decide the question. This is to be carried out by a station selected in the same way as for the decisive analysis. The result is judged as under § 8 for sugar beets.

Appendix. — Directions for sampling mangel seeds.

Unless carried out by a sworn sampler, the sampling takes place as follows :

For lots up to 10 packages, all the packages must be drawn upon in the preparation of the sample ; with more than 10, one in ten must be used, with the proviso that at least 10 remain unopened.

Injured packages are not to be used even when accepted by the purchaser.

The packages selected are to be opened in such a way that samples may be taken from the top, the middle and the bottom, or else so that they can be turned right out and the seed well mixed ; at least ten samples are then to be taken from the heap (top, middle and bottom). The samples so obtained are to be put together, carefully mixed and divided into at least four equal parts. Each of these parts must weigh at least 200 gms. (7 oz.).

The samples for the determination of moisture content are to be enclosed in air-tight glass bottles or tins (as for sugar-beet seed). Those for germination tests are to be packed in linen or double paper bags, and must not be kept in air-tight vessels. All must be labelled in such a way that their origin can at any time be ascertained.

An impartial witness must be called in for the sampling; he stamps the seals or leads of the closed samples with his seal. The sample remitted must be accompanied by the witness' certificate of sampling, on which it must be stated that the samples were duly taken in his presence. The other samples must be kept in a dry unheated room in case they should be required for further investigations.

The vendor has the right to have similar samples taken on the purchaser's property, at his own expense, for examinations which he wishes made. If both parties have had samples taken, each must send in his sample for comparison in case a decisive analysis is required; the average of these two samples is taken as the decisive figure.

Formulae for the calculation of reduction of price on seeds below standard but saleable.

In the formulae, the values for dry matter and purity may only be inserted if they are within the limits set out in the regulations.

A balancing of excesses and deficiencies is only allowable in germination values (see § 4 above). No latitude is allowed outside the limits for delivery given in the regulations.

If the price is to be reduced under *either* § 2 *or* § 3 the following formula is to be used:

$$\frac{\text{price agreed upon} \times \text{value of seed delivered}}{\text{guaranteed value.}};$$

but if *both* § 2 *and* § 3 require a reduction, the price is obtained by the formula:

$$\frac{\text{price agreed upon} \times \text{actual dry matter} \times \text{actual purity}}{85 \times 96}.$$

If reduction is to be made under § 4 it is obtained as follows:

$$\text{price agreed upon} \times \frac{\dfrac{\text{seedlings germinating in 14 days in 1 gm.}}{60} + \dfrac{\text{clusters germinating in 14 days}}{75 \text{ (or } 70)}}{2}$$

In the last formula, the two figures for germination must both be entered, even when one of them is up to or above standard.

If reduction is required under §§ 2, 3 and 4, the corrected price from the second formula is substituted for " price agreed upon " in the last formula.

595 – **Agricultural Shows.**

AGRICULTURAL SHOWS AND CONGRESSES

Argentine Republic.

1914 Aug. 15-23. Buenos-Aires. — Agricultural show organized by the "Sociedad Rural Argentina".

Belgium.

1914 Aug. 29 (opening). Arlon. — Regional agricultural competition, organized by the "Société agricole de Luxembourg"; there will also be an agricultural exhibition, including several international sections. Address to "Secrétariat de la Société agricole du Luxembourg", Arlon, Belgium.

Canada.

1914 Sept. 3-12. Vancouver. — Agricultural and industrial exhibition.

Egypt.

1915 Feb. or early March. Cairo. — Agricultural show organized by the Khedivial Agricultural Society.

France.

1914 Sept. 11-13. Quimper. — Show of Breton Black-and-white Cattle. Also exhibition of agricultural machines and implements, and trials of potato-diggers.

Dec. 24-28. Paris, Grand Palais. — International Poultry and Rabbit Show, held by the "Société nationale d'Aviculture de France". Address of the Society: 34, rue de Lille, Paris.

1915 March 4-8. Nice. — Great Triennial Flower Show, organized by the "Société d'Horticulture pratique de Nice."

Germany.

1914 Sept. 19-23. Siegburg. — Provincial show, held by the "Landwirtschaftlicher Verein für Rheinpreussen."

Oct. 3-5. Hamburg. — Fourth fat stock show.

1915 May 8-11. Karlsruhe. — First fat stock show for Baden, organized by the city of Karlsruhe and the Chamber of Agriculture of the Grand Duchy of Baden.

Italy.

1914 Sept. 20-30. Quistello (Mantua). — Dairy industry show. Also national poultry show, interprovincial pig show and exhibition of agricultural produce.

United Kingdom.

1915 Edinburgh. — Competition for potato-planters. Address to: J. Stirton, 3 George IV Bridge, Edinburgh.

United States.

1915 Jan. 1-Dec. 31. San Diego (California). — International Exhibition, with the following sections: Agriculture; Food Products; Commerce and Industry; Domestic Economy.

596 – Agricultural Congresses.

Austria.

1914 Sept. 5-13. Göritz. — Ninth Austrian Wine-makers' Congress. Address: Geschäftsleitung des österreichischen Reichs Weinbauvereines, Wien III, Fasangasse 48.

France.

1914 Aug. 3 (opening). Lyons. — National congress on technical education in industry, commerce and agriculture. General Sec., 5 rue Jussieu, Lyon.

1915 April 6-9. Marseilles. — 53rd Congress of the Sociétés Savantes.

Hungary.

1914 Sept. 6-17. Budapest. — Eighth Congress of the International Union of Forestry Research Stations. Excursions will include: Szabadka (trials of fixation of shifting sands, stands of *Robinia*); Kiralyhalom (Secondary Forestry School); Puszta of Déliblát (old stands of Scots and Austrian pine, and plantations of *Robinia* carried out in a special way on shifting sands); Vadászerdö (forests of pedunculate oak, plantation of foreign trees and experimental plots): Gödöllö (Arboretum of the Archduke Joseph); Selmeczbánya (Central Hungarian Forestry Research Station, comprising: arboretum, nursery, experimental plots, meteorological station); Ohegy (domainial forest); Lake of Csorba, at 4500 ft. — Persons wishing to attend the excursions and meetings should send their names to the Secretariat of the Union, 3 rue de Louvain, Brussels.

CROPS AND CULTIVATION.

597 – **Variation in the Nitrate Content of the Soils in Scania, Sweden.** — WEIBULLL, M. in *K. Landtbruksakademiens Handlingaroch Tidskrift*, Year 53, No. 2, pp. 65-93. Stockholm, 1914.

The writer employed the Grandval-Lajoux method of estimating nitrates in soils, which proved very delicate and reliable. Samples were taken from different points of a soil and tested separately, not mixed to form a composite sample, as the variation from point to point may be considerable; care was also taken not to sample a soil twice in the same place, as each disturbance causes increased aeration and influences nitrification.

During five years the soil of a field was systematically tested for nitrates both on cropped and uncropped plots, to follow the variations due to season and soil management; manurial dressings were identical on the cropped and uncropped plots. The results are set out in Table I (p. 860); the treatment of the field was as follows:

1907. — Seeds: mown in June, dunged, ploughed and harrowed and sown with wheat on September 2.
1908. — Winter wheat: received 180 lbs of nitrate of soda per acre on April 24, harvested on August 12, dunged and ploughed September 12.
1909. — Sugar beet: receved a dressing of nitrate of soda May 20, lifted October 21, ploughed November 15.
1910. — Spring wheat: sown April 8, harvested in August, dressed with liquid manure and ploughed November 11.
1911. — Peas: sown in May, harvested August 10.

The nitrate content never exceeded 22 parts per million on cropped soil, while on fallow land it rose to 33. Among the cropped plots, those under beets contained up to 14 parts of nitrogen, those under wheat and peas only 8 or 9 parts, and those under seeds least of all (*viz.* 1.5 parts), but as soon as the latter were dunged and ploughed up nitrates increased to 6 parts per million and continued to accumulate right up to November, developing a nitrate content of 21 parts per million. Then the content decreased owing partly to absorption by the growing wheat and partly to washing out by rain, a loss which was verified later on other fallow plots. In the spring, nitrates were scarce; nitrification began again at seeding time but the nitrate content only became appreciably higher after the application of nitrate of soda, *i. e.* towards the middle of May. During the early summer the nitrate content generally increased, as did nitrate assimilation, evidenced by the difference between cropped and uncropped plots.

Influence of cultivations and vegetation on the nitrate content of soils. — In 1910 a piece of new ley (clover and grass in equal quantities) was divided into three equal parts of 10 sq. metres (107 sq. ft.) each; one of these was left in seeds, the second was freed from grass and clover and

TABLE I. — *Nitrogen as nitrate in the soil to a depth of 12 in., parts per million.*

Month	1907					1908			1909						1910						1911					
	Seeds, winter wheat sown (1)					Winter wheat (2)			Beets (2)						Spring wheat (2)						Peas (2)					
	Cropped land					Cropped land			Cropped land			Fallow land			Cropped land			Fallow land			Cropped land			Fallow land		
Jan.			—			2.5	1	—	3	—	—	3	—	—	—	—	—	—	—	—	3	—	—	3	—	—
Feb.			—			1.5	2.5	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
March			—			1.5	2.5	—	—	—	—	—	—	—	—	—	—	—	—	—	3	2.5	2	3	2.5	2
April			—			3	1.5	7	—	2.5	2	—	2.5	5	2	5.5	3.5	2.5	5.5	3.5	4.5	6	4.5	5	5	3.5
May			—			5	2.5	1	3	2.5	10.5	3	3	7	8	9	8.5	4.5	7	4.5	5.5	8	7	3.5	7	5
June			—			3	2.5	1.5	7	14	13	7.5	12	12	3.5	4	2.5	6.5	4.5	4.5	6.5	4.5	2	4	7	4
July			—			—	—	—	14	6	3.5	21	32	33	2.5	1.5	1.5	4	3.5	4	2	2	5	3.5	3.5	3.5
Aug.	1.5	6	7.5	8.5	9.5	1	2.5	1	1.5	1	1.5	16	14.5	11.5	1.5	4.5	2.5	5	8	5	2.5	—	—	4.5	—	—
Sept.	7.5	14.5	10	14	—	1	1.5	2	1.5	2	1.5	10.5	—	12	4.5	1.5	3	8	4	5.5	—	—	—	—	—	—
Oct.	20	14	20	21	—	3	—	—	1	1.5	2	16	16	7.5	1	2	1	2	2	2	—	—	—	—	—	—
Nov.	21.5	21	17	13.5	8	6	—	—	—	—	—	—	—	—	2	2	—	2	2	—	—	—	—	—	—	—
Dec.	9.5	6.5	4.5	—	—	—	—	—	1.5	4	2	7.5	8	5.2	1	—	—	2	—	—	—	—	—	—	—	—

(1) Samples taken every week.
(2) » » 1st, 11th, 21st of each month.

kept bare of vegetation and the third was dug over to a depth of 12 in. on March 8. Nitrate and moisture contents are given in Table II.

TABLE II.

Date	Nitrates as *N* in parts per million			Moisture per cent		
	In seeds	Bare, weeded	Dug	In seeds	Bare, weeded	Dug
April 8	1.5	2.0	1.5	—	—	—
» 21	2.1	4.7	2.3	—	—	—
May 2	2.8	5.3	4.0	—	—	—
» 11	1.5	3.7	6.5	—	—	—
» 21	1.8	4.7	5.7	—	—	—
June 1	1.7	5.7	14.0	—	—	—
» 10	3.3	7.0	18.7	5.3	8.6	9.7
» 19	3.7	6.8	14.0	—	—	—
July 1	4.3	—	12.0	—	—	—
» 10	2.0	10.3	19.7	—	—	—
» 20	3.0	9.7	24.0	—	—	—
Aug. 1	2.3	9.7	11.3	6.7	10.1	10.25
» 11	1.5	7.7	10.3	8.81	10.82	10.25
Mean . .	2.4	6.5	11.3			

Nitrate content of the control plot in seeds remained low, averaging 2.4 parts per million and reaching a maximum of 4.3 parts at the beginning of July when vegetation was already in an advanced condition ; this plot was always driest. In the bare weeded soil the nitrate content was about three times as large and did not attain its maximum till later in July. In the dug over plot the nitrate content was about twice that of the second plot, but the moisture content remained approximately equal.

Influence of nitrate content on yield. — Samples of soil were taken throughout the growing season on a certain number of farms from plots having received a dressing of nitrate of soda, superphosphate and potash and from unmanured plots ; these samples were analysed for nitrates. The results show that soils in Sweden do not generally contain sufficient nitrate to provide for the requirements of plants, and this is especially the case with land under cereals or grass ; corn fields will only attain a nitrate content of 10 parts per million if they have been dressed with nitrogenous fertilizers and will reach their maximum at the end of May or beginning of June ; grass fields are usually lowest of all. Land under root crops or fallow is usually richer, and root fields may contain as much as 10 parts per million towards the end of June. When land is broken up after harvest, nitrification be-

comes active and nitrates accumulate more than at any other time. The maxima reached earlier in the season are only maintained a very short time, for nitrification decreases and plant assimilation is active ; on unmanured fields, nitrates become scarce after one or two months and crops suffer from starvation ; on manured soils a somewhat higher nitrate content is maintained for some time.

The writer investigated the question as to whether it were possible to detect the point at which nitrogenous manuring becomes necessary. Soils under beets were analysed during July and August ; the results are set out in Table III.

TABLE III — *Soils under beets.*

Place of trial	Yield on unmanured soil	Increase due to complete manuring	Nitrates as N in parts per million					
			July I	July II	July 21	Aug. I	Aug. II	Aug. 21
	tons	tens						
Alnarp 1909	39.0	0.6	9.3	6.3	6.2	2.5	1.7	1.7
Barsebäck	35.6	3.5	13.0	6.7	—	4.0	3.7	—
Alnarp 1910	41.3	4.0	10.7	6.3	2.8	3.7	5.0	2.2
Ola Siversson . . .	30.9	4.4	14.7	7.3	8.0	3.0	2.3	—
Alnarp 1908	40.5	4.7	7.3	6.3	2.7	1.7	1.8	2.5
Månsson Önnerup .	33.1	6.6	7.7	4.3	—	2.3	2.3	—
Alnarp 1907	30.0	6.6	8.5	8.0	2.0	2.5	4.0	1.2
Bomhög	37.0	7.8	8.0	5.8	2.0	1.7	1.0	1.7
Mean			9.9	6.4	4.0	2.5	2.6	1.9

In the course of the two months, the mean nitrate content fell gradually from 9.9 to a minimum of about 2 parts per million. If the time at which this minimum content is first observed in each case be considered in relation to the increase in the crop caused by the nitrogenous manuring, it would appear that when the depletion of nitrate (2 parts per million) occurs early in the season, *i. e.* before the beginning of August, a nitrogenous dressing causes a fairly large increase of crop, but that the increase is less considerable if the scarcity of nitrates does not make itself felt till the middle or end of August ; these dates would be liable to modification with the character of the season. The nitrate content of plots dressed with nitrate of soda never sank to such a low level as that of the unmanured plots.

Under normal climatic conditions then, a nitrate content of 2 parts per million at the end of July in unmanured fields of beets would indicate the necessity of applying a nitrogenous dressing, while if this low level does not appear till the middle or end of August, the natural content of the soil would be sufficient for the crop. According to RÉMY, it is just in July that beets develop a high capacity for assimilation, so that the results obtained above would not be unexpected. Probably a similar

period of maximum assimilation exists for other cultivated plants and it would be of great interest to extend investigations to other crops. Three trials carried out with forage crops gave in one case a large increase with a nitrogenous dressing, in the second case an appreciable increase, and in the third no increase, while the nitrate content of the respective soils sank to the critical point (2 parts per million) in June and before August in the two first cases, while the scarcity was never apparent in the third case. In one trial with potatoes the nitrate content of the soil sank to 2 parts per million on July 1, and a handsome increase was obtained with a nitrogenous dressing. In three trials carried out with spring corn, scarcity of nitrates was observed in one case in May and in the two other cases on August 1 and August 11; response to nitrogenous dressing was only obtained in the first case.

598 – **Experiments on the Rate of Nitrification.** — BEESLEY, R. M. in *Journal of The Chemical Society*, Vols. CV and CVI, No. DCXVIII, pp. 1014-1024. London, April 1914.

The rate of nitrification was determined for the following substances: carbamide, thiocarbamide, uric acid, asparagine, glycine, acetamide, aniline sulphate, methylamine sulphate, ammonium oxalate and ammonium sulphate and a special form of apparatus was devised so as to enable samples of the nitrifying solutions to be withdrawn without exposing the contents to accidental contamination from the organisms contained in the atmosphere. A suitable mixed culture of hydrolytic and nitrifying organisms was obtained from the secondary contact beds of a local sewage works. The course of hydrolysis and nitrification in the various solutions was traced by means of periodic determination of the ammoniacal, "nitrous" and "nitric" nitrogen figures. The ammoniacal nitrogen was determined by direct Nesslerisation of diluted portions of the nitrifying solutions. During the early stages of fermentation the "nitrous" nitrogen was determined by means of the anaphthylamine and the sulphanilic acid test, but as the concentration reached 3 parts per hundred thousand, Duyk's volumetric method using iodine was adopted. The first appearance of nitric acid was detected by means of brucine and sulphuric acid, and the quantity of "nitric" nitrogen was determined as ammonia by reduction with a zinc-copper couple.

No nitrification took place in the solutions containing thiocarbamide and aniline sulphate. Ammonia was produced in the latter to the extent of 90 per cent. of the original nitrogen in solution, showing that the aniline was merely hydrolysed. However, no phenol was detected, probably owing to its destruction by bacterial agency. Nitrification took place in all the other solutions at approximately the same rate. In the case of the ammonium salts there was a temporary disappearance of nitrogen between the 30th and 60th days of fermentation. This loss of nitrogen becomes noticeable before any nitrate makes its appearance, and since the oxidation from nitrous to nitric acid consists of only one step it appears that it is in some stage of oxidation between ammonia and nitrous acid that the nitrogen becomes non-realisable.

The writer therefore concludes that intermediate substances of the nature of hydroxylated ammonium radicles are formed in the bacterial oxidation of the ammonium radicle.

599 – **Humus in California Soils.** — LOUGHRIDGE, R. H. in *California College of Agriculture Experiment Station, Bulletin* No. 342, pp. 49-92. Berkeley, Cal., January 1914.

The soils of California are characterised by the presense of humus to beyond twelve feet below the surface. There is not the sharply defined change of the black humus colour to grey at a depth of 6 or 9 inches, characteristic of normal humid soils. In some of the heavy clay soils a change in colour takes place at a depth of three feet, but for the most part the change in tint is very gradual downward through many feet. The average quantity of humus in 109 Californian soils is 1.35 per cent. for the first foot and a sum of 3.17 per cent. for the first three feet, equivalent to about 126 800 lbs. per acre. The average humus content of 280 humid soils of the United States is 2.63, or approximately 105 000 lbs. per acre.

Thus, even excluding the humus below a depth of 3 feet, the arid soils of California contain more humus than the humid soils of America. The wonderful endurance of drought on the part of plants in Californian soils is due to this distribution of humus through a depth of many feet and the consequent deeper root penetration.

Professor Lipman has shown that nitrifying bacteria are present and active in California soils to a depth of six feet, and ammonifying bacteria are present through a depth of twelve feet, thus making available the nitrogen content of the humus to these depths.

Phosphoric acid is present in the humus of Californian soils to the extent of from 0.01 per cent. to 0.08 per cent. throughout the entire depth, though usually most abundant in the upper few feet.

600 – **Soils with a Mineral Acidity.** — LOEW, O. in *Landwirtschaftliche Jahrbücher*, Vol. 46, Part 1, pp. 161-164. Berlin, 1914.

According to the writer, in considering soils with an acid reaction, a distinction is to be drawn between those in which this property is due to the presence of humus, and those which have a mineral acid reaction.

Soils with mineral acidity have recently formed a subject of research for agricultural chemists. Daikuhara, who was the first to turn his attention to this question, reported seven years ago that soils devoid of humus might have an acid reaction, and that this acid property was due to the clay. He also found that such soils exist, not only in Japan, but also in Corea and along the Chinese coast, countries in which the frequent summer rains may wash the basic elements out of the soil. Acid clays are also found fairly frequently in Germany and in the United States. According to Daikuhara these soils, when manured with neutral salts, as, for example, chloride of potash or sulphate of ammonia, become even less fertile than they would be without any manure, because the insoluble acids of the clay, uniting with the bases, liberate acids (in this case sulphuric and hydrochloric), and thus increase the acid nature of the soil. The writer concludes that acid soils should only be manured with basic fertilizers.

601 — **The Influence of Irrigation and Crop Production on Soil Nitrification.** — McBeth, I. G. and Smith, N. R. in *Centralblatt für Bakteriologie, Parasitenkunde und Infektionskrankheiten*, Vol. 40, No. 1-8, pp. 24-51. (article written in English). Jena, February 16, 1914.

These nitrification studies were carried out on the Greenville Farm belonging to the Utah Agricultural Experiment Station. The soils are of sedimentary origin and contain no particles larger than "fine sand". Chemical analysis shows them to be exceptionally rich in the mineral plant food constituents, but characteristically low in humus and possessing only a fair nitrogen content. The surface soil to a depth of one foot contains 43 per cent. of calcium and magnesium carbonate in the ratio of 1 lime : 2.8 magnesia.

The influence of irrigation and growing crops on nitrification was determined by measuring the rate of nitrification of ammonium sulphate and dried blood when added to samples of the soils. Water from the Logan River was used for irrigation and was of fairly constant composition during the season. Analysis showed it to have a very low fertilising value and to contain less than 400 parts of total residue per million.

The results obtained in these experiments are as follows :

1) The nitrifying power of the surface foot of soil was ten times that of the second foot and many more times that of the third, fourth, and fifth foot respectively.

2) Irrigation decreases the nitrifying power of soils, especially in the first two feet. This effect continues during the following season.

3) More than 50 per cent. of the full water capacity of the soil is required for maximum nitrification, but the quantity varies considerably with different soils. Maximum nitrification is generally secured when the soil is just on the point of becoming sticky. Too small a supply of moisture has a greater effect in retarding nitrate formation in these soils than a too liberal application.

4) The additon of a quantity of nitrogen as ammonium sulphate greater than 170 parts per million showed an inhibiting action on the nitrifying organisms. In no case was as much 50 per cent of the nitrogen added as ammonium sulphate recovered in the form of nitrate.

5) Growing crops such as afalfa, potatoes, oats and corn increase the nitrifying power of the soil, the effect being greatest in the case of alfalfa.

6) The greatest gain in nitric nitrogen was obtained from the alfalfa land when ammonium sulphate was used as the nitrifiable substance ; when dried blood was substituted for ammonium sulphate, the greatest gain was from the oats land.

7) The smallest gain with both ammonium sulphate and dried blood was obtained from the fallow land.

609 — **The Great Artesian Basin of Australia.** — *Journal of the Royal Society of Arts*, Vol. LXII, No. 3202, pp. 438-440. London, April 3, 1914.

The largest of all artesian basins is that in the eastern half of Australia, and it has been brought into prominence recently by the discovery of

a serious falling off in the supply. A Conference of the most eminent geologists and engineers from all the States was appointed with the object of discovering the cause, in view of arresting the decline in the output, and now its report has been published. The basin in question is roughly triangular in shape, and about 1000 miles in maximum length from north to south and about the same from east to west. The intake surface beds which supply nearly all the water are on the eastern side of the basin, being in a more rainy country than on the west, and they coincide generally with the western slope of a belt of high country parallel to and about 200 miles from the coast. This belt is for the most part composed of porous Triassic freshwater sandstones. It has been estimated that 13 200 million gallons daily reach the stratum down to which bores are being driven, while about 700 million gallons are being drawn from the wells. As in most artesian basins, the lip of the subterranean basin dips in some places and allows a certain amount of water to escape ; in this particular case also, it has been ascertained that there is a considerable escape at the north end into the Gulf of Carpentaria.

The first discovery of artesian water was made in 1879; since then 84 000 square miles of country in New South Wales and 376 000 square miles in Queensland were found to be water bearing under natural pressure. Large areas of these tracts are within the 10-inch and the 20-inch average yearly rainfall, these amounts being also exceedingly irregular in incidence. Therefore as bore sinking advances vast pastoral districts in which millions of sheep died in drought times, are gradually being transformed into areas in which access to water is ensured, and great losses of stock are avoided.

According to latest returns 2 336 wells have been sunk, yielding, as said above, 700 million gallons daily. The maximum and minimum depths are 5 045 feet and 5 feet, and the temperature of the water ranges from 148° F. to 70° F., increasing approximately 1° for every 44 feet.

The wells are almost exclusively used for watering stock, but in some places they have been used for township water supply and for the production of power, but not for irrigation, the quantities being generally too small. The recent Conference has advised prohibiting (with some exceptions) the employment of the water for any purpose other than that of watering stock.

The diminution in the supply had been noticed in a few cases since 1894, but about 10 years ago it became clear in many instances and since then it has become more or less marked over all the area of the great basin.

It was thought by some that local escape through defective casing of the bores or occasional drought over the intake beds might be the cause of the mischief, but the evidence before the Conference was not considered sufficient to confirm these opinions.

The Conference, in spite of the voluminous evidence collected, has not been able to come to any definite and complete conclusion as to the cause of the decline in the supply, and it has confined itself to recommending that more data be furnished to a Permanent Board sitting annually and that the laws affecting artesian water supply be made uniform in all the States.

603 – **Progress in Irrigation in South Africa.** — *Daily Consular and Trade Report*, Year 17, No. 40, p. 786. Washington, February 27, 1914.

Under the system of irrigation boards, no fewer than 30 districts have been proclaimed in the Cape Province alone, the capital expenditure involved being $4 136 000 ; a number of Government irrigation settlements exist in the Cape, Transvaal and Orange Free State Provinces. Boring is proceeding on nearly 500 farms and during the year ended March 31, 1913, 93 holes were completed having a total footage of 18 440 and a yield of 1 321 500 gallons per day.

The pumps most in use in South Africa are a reciprocating type suitable to varying capacities and heights and to installations where the water supply is irregular.

In regard to motive power for small pumping installations, oil engines up to 6 HP are very commonly used. For larger installations suction gas plants are extensively employed, the most important to date being a 108 brake HP equipment at Grahamstown. In some districts anthracite coal is available and cheap to use, but suction gas plants are more widely in demand and are already the accepted type for irrigation works of any size.

604 – **Technical Precautions Necessary in the Electrification of Crops.** — PRIESTLEY, J. H. (Some recent experiments in the application of electricity to plant production) in *The Gardeners' Chronicle*, Vol. LV, No. 1424, pp. 245-247 and No. 1425, p. 271. London, April 18, 1914.

Previous experiments have been carried out in ignorance of the complication and sources of error attendant in the management of high potential discharges. The techinical difficulties to be overcome are :

1. Adequate insulation of the wires.
2. Changes in the area of distribution of the discharge by wind.
3. A simple and accurate method of determining the electrical condition of the atmosphere above each plot.

The changes in the direction of the discharge produced by changes in the intensity and direction of the wind will confuse the issue of all experiments, however carefully planned otherwise, if precautions are not taken to ensure normal electrical conditions for the control plots. The difficulties of controlling the electrical conditions without interfering with the other physical conditions of the plots are so great that it is necessary to make accurate records of the electrical condition of each plot throughout the experiments before the results can be interpreted satisfactorily. Further, no comparisons of experiments made in different localities, or at different times, can be made, unless the particular electrical conditions prevailing at the time are considered.

Efficient insulators and a simple apparatus for the determination of the distribution of the electrical discharge have been divised. With a due appreciation of the importance of these factors, the application of electricity to growing crops becomes a simple matter, and distinct improvement in the progress of this study is to be expected.

MANURES AND MANURING

605 – **Production and Consumption of Fertilizers in the World.** — INTERNATIONAL INSTITUTE OF AGRICULTURE, BUREAU OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES, *Production et consommation des engrais chimiques dans le monde*, Second edition, pp. 162. Rome, 1914 (1).

The production, consumption and trade in fertilizers is of an eminently international character, as no country is in a position to provide for all its own wants in that respect; moreover, while the use of artificial manures is gradually spreading to all cultivated parts of the globe, the raw material from which they are produced is concentrated in only a few points. The present edition of the above publication has been completed with regard to the world movement of fertilizers by data for the colonies which were not available in 1913.

Production.— The world's production of the principal fertilizers during 1910, 1911 and 1912 is given in Table I, together with similar data for 1903.

TABLE I. — *Total production of fertilizers (metric tons).*

	1903	1910	1911	1912
Phosphatic manures.				
Mineral phosphates	3 098 866	5 609 760	6 181 199	6 852 343
Basic slag	3 243 500	3 275 845	3 506 500	3 988 000
Superphosphate	5 130 900	9 604 260	10 000 000	11 000 000
Guano	71 100	61 000	83 000	72 000
Total	10 544 366	18 550 865	19 770 699	21 912 343
Potash manures.				
Potash salts	4 078 268	9 285 408	10 985 760	12 531 216
(containing K_2O)	(366 421)	(857 883)	(939 927)	(1 009 219)
Indian saltpetre	18 711	16 140	14 910	15 036
Others (given as K_2O)	—	28 000—44 000		
Nitrogenous manures.				
Nitrate of soda	1 485 279	2 465 415	2 522 120	2 586 975
Sulphate of ammonia	582 206	1 053 994	1 198 363	1 327 508
Cyanamide	—	30 000	52 000	95 000
Nitrate of lime	25	25 000	50 000	75 000
Total	2 607 510	3 574 409	3 822 483	4 084 483

The Seychelles have recently provided a new source of guano, producing 22 260 metric tons in 1911.

(1) Price 3.50 fr., to be obtained of the International Institute of Agriculture, Rome

The figures for the total amount of phosphatic manures are too high, as the mineral phosphates are counted twice over, being largely used in the manufacture of superphosphate.

It is not possible to give exact figures for the total production of potassic manures, but the great bulk of these is in the form of potash salts (Stassfurt). Modern developments in the production of potash manures consist in the extraction of potash; 1) from seaweed in the United States, by which means it is estimated that an annual yield of 1 000 000 tons of potassium chloride (equivalent to 630 000 tons of K_2O) might be obtained; and 2) from the felspars, also in the United States, by which means a possible annual yield of 400 000 tons of potash is estimated.

With regard to the nitrogenous fertilizers, the production of sulphate of ammonia is five times as large as it was twenty years ago, and there has lately been introduced a new method of extracting it from peat; the process, known as the Mond-Frank-Caro process, extracts from 90 to 180 lbs. of sulphate of ammonia from one ton of peat. The production of synthetic nitrogenous fertilizers since 1903 is given below, together with estimated figures for 1913 and 1914 (in brackets).

	Calcium cyanamide	Nitrate of lime
	metric tons	metric tons
1903	—	25
1904	—	550
1905	—	1 600
1906	500	1 600
1907	2 200	15 000
1908	8 300	15 000
1909	16 000	25 000
1910	30 000	25 000
1911	52 000	50 000
1912	95 000	75 000
1913	(97 000)	(140 000)
1914	(208 000)	—

Particulars as to the place of production of mineral phosphates, basic slag and sulphate of ammonia are as follows:

Mineral phosphates.

United States	3 216 046 metric tons
Tunis	1 923 000 »
Algeria	388 515 »
France	300 000 »
Christmas Island	300 000 »
Ocean and Mauru Islands	300 000 »
Belgium (excluding phosphatic chalk)	203 100 »
Egypt	69 958 »
Angaur (Palan Islands)	50 000 »
Makatea (Society Islands)	40 000 »
Dutch Antilles	20 362 »

Russia	25 000 metric tons
South Australia	6 198 »
French Guinea	7 230 »
Spain (1911)	3 520 »
Japan, apatite (1911)	2 271 »
Sweden (1907)	5 317 »
Norway (1911)	897 »
Canada	164 »
Basic slag.	
Germany	2 475 000 metric tons
France	679 000 »
Belgium	534 000 »
United Kingdom (1910)	160 000 »
Austria-Hungary	73 000 »
Others, including United Kingdom (1911)	200 000 »
Sulphate of ammonia.	
Germany	492 000 metric tons
United Kingdom	394 521 »
United States	149 700 »
France	68 500 »
Belgium	43 700 »
Holland	6 000 »
Austria-Hungary	34 550 »
Italy	11 731 »
Spain	12 000 »
Russia	4 000 »
Japan	4 000 »
Australia	3 000 »
Denmark	2 000 »
Sweden	1 400 »
Others	100 000 »

Consumption .— The world's consumption of the principal fertilizers during 1910, 1911 and 1912 is given in Table II.

TABLE II. — *World's consumption of fertilizers* (*metric tons*).

	1910	1911	1912
Mineral phosphates	5 500 000	6 000 000	6 500 000
Superphosphates	9 500 000	10 000 000	11 000 000
Basic slag	3 000 000	3 330 000	3 500 000
Peruvian guano	32 000	61 000	83 000
Potash salts	4 039 622	4 353 000	4 520 959
(containing K_2O)	(766 200)	(848 705)	(904 000)
Nitrate of soda	2 359 652	2 401 392	2 530 645
Sulphate of ammonia	1 000 000	1 000 000	1 200 000
Synthetic nitrogenous manures	50 000	75 000	150 000
	25 500 000	27 000 000	29 500 000

TABLE IV. — *Intensity of fertilizer consumption in different countries.*

Number	Country	Total consumption of fertilizers	Area of agricultural land	Intensity of consumption	Order of intensity
		quintals	hectares	qls. p. ha	
1	Germany	59 065 300	35 055 398	1.68	2
2	German colonies	.....	.....	undetermined	7
3	Argentine Republic	6 188	18 775 672	0.003	6
4	Austria	5 451 900	18 422 238	0.29	4
5	Hungary	2 293 100	22 182 718	0.10	4
6	Belgium	5 249 148	1 916 690	2.47	1
7	Brazil	85 219	.....	undetermined	7
8	Bulgaria	3 680	4 840 760	0.0008	6
9	Chile	168 573	2 024 295	0.08	5
10	China	460 361	.....	undetermined	7
11	Cuba	113 500	2 059 111	0.06	7
12	Costa-Rica	3 772	61 480	0.06	7
13	Denmark	1 639 157	2 890 784	0.57	3
14	Ottoman Empire	.....	.....	undatermined	7
15	Cyprus	.....	.....	*id.*	7
16	Egypt	559 620	3 326 755	0.21	4
17	Ecuador	26	.....	undetermined	7
18	Spain	5 813 203	40 683 000	0.14	4
19	United States — Southern	53 364 500	193 624 639	0.87	3
	United States — North Eastern			0.47	4
	United States — Central			0.0264	5
	United States — Western			0.0456	5
20	Philippine Is.	6 899	.....	undetermined	7
21	Porto Rico	.....	.....	*id.*	7
22	France	21 161 656	36 798 715	0.58	3
23	Algeria	435 000	3 712 635	0.12	4
24	Tunis	165 900	1 570 000	0.10	4
25	Marocco and Indochina	.....	.....	undetermined	7
26	Other French colonies	.....	.....	*id.*	7
27-28	United Kingdom — Great Britain	10 160 000 13 120 000	18 198 590	0.70–0.92	3
	United Kingdom — Ireland	2 300 000 2 650 000	6 997 736	0.44–0.50	4
29	Australia	2 655 725	4 944 500	0.55	3
30	Canada	320 183	12 756 055	0.03	5
31	Ceylon and Straits Settlements	.....	.....	undetermined	7
32	British India	18 647	90 269 783	0.0002	6
33	West Indies, British Guiana, Bermudas	.....	.....	undetermined	7
34	Mauritius	166 522	75 767	2.19	1
35	New Zealand	2 038 830	16 283 566	0.13	4
36	Union of South Africa	398 560	1 384 548	0.29	4
37	Greece	60 408	1 429 230	0.04	5
38	Guatemala	.....	.....	undetermined	7
39	Italy	11 910 950	20 772 892	0.57	3
40	Eritrea and Italian Somaliland	.....	.....	.....	8
41	Lybia	.....	.....	.....	8
42	Japan	3 707 459	7 694 892	0.48	4
43	Formosa	.....	762 249	undetermined	7

Number	Country	Total consumption of fertilizers	Area of agricultural land	Intensity of consumption	Order of intensity
		quintals	hectares	qls. p. ha	
44	Luxemburg	312 000	154 832	2.02	1
45	Mexico	46 958	.....	undetermined	7
46	Montenegro	.....	.....	.....	8
47	Nicaragua	.....	.....	undetermined	7
48	Norway	681 173	2 373 276	0.29	4
49	Paraguay	.....	.....	undetermined	7
50	Holland	4 259 220	2 177 642	1.96	2
51	Dutch East Indies	1 000 000	5 152 739	0.20	4
52	» Guiana	.....	.....	undetermined	7
53	» Antilles	.....	.....	*id.*	7
54	Peru	.....	.....	*id.*	7
55	Persia	.....	.....	.....	8
56	Portugal	1 528 147	5 037 665	0.36	4
57	Rumania	43 550	7 691 363	0.01	5
58	Russia	5 935 176	99 600 000	0.06	6
59	Finland	.....	2 849 304	undetermined	7
60	Russia in Asia	.....	25 218 627	*id.*	7
61	Salvador	31 620	.....	*id.*	7
62	Servia	15 485	1 839 106	0.0084	6
63	Sweden	2 662 868	5 006 272	0.53	4
64	Switzerland	1 186 398	2 234 034	0.53	3
65	Uruguay	25 529	829 934	0.03	5
66	Bolivia	.....	.....	undetermined	7
67	Columbia	.....	.....	*id.*	7
68	Haïti	.....	.....	.....	8
69	Honduras	.....	.....	.....	8
70	San-Domingo	.....	.....	.....	8
71	Siam	.....	.....	.....	8
72	Venezuela	.....	.....	undetermined	7

As in Table I, the totals are again somewhat too high on account of the mineral phosphates being employed in the manufacture of superphosphate. The value of the total consumption was below £ 80 million in 1910 and above that figure in 1912.

Table III is a first attempt to determine the intensity of consumption of fertilizers in the different countries. The figures in the last column represent the order of intensity according to the following scheme:

	Mean consumption of fertilizers in quintals per hectare of agricultural land
1	over 2 quintals (180 lbs. per acre)
2	1 to 2 » (90 to 180 »)
3	0.5 to 1 » (45 to 90 »)
4	0.1 to 0.5 » (9 to 45 »)
5	0.01 to 0.1 » (0.9 to 9 »)
6	less than 0.01 » (0.9 »)
7	undetermined
8	no data

An extensive bibliography is appended to the publication, which, in its present (second) edition, forms the starting point for the half-yearly Review (*Revue semestrielle du mouvement international des engrais chimiques*). The publication of this Review was decided upon at the last General Assembly of the Institute (Inst. Int. d'Agr., 4ème Ass. gén., Décis. II, Rapp. Pioda-Laur, 1913) and the first number will appear on September 1, 1914.

606 – **Five Years' Manuring Experiments in East Prussia.** — STUTZER, A. in *Arbeiten der Deutschen Landwirtschafts-Gesellschaft*, Part 258, 236 pp. Berlin, 1914.

The writer, with his collaborators, carried out in the five years 1909 to 1913, 66 field manuring experiments on 15 different estates, and 17 trials of manures for meadows and pastures on several farms. The most important results obtained are the following.

1. *Potash.* — According to the literature on the subject, potash manures are credited with protecting winter cereals and other plants against frost, and this when the potash manures have been spread before sowing and the plants have taken up and elaborated the potash. According to the writer, it is very probable that the effect of potash manures in this direction depends rather upon certain accessory circumstances than upon the plant-food potash itself.

In the experiments, the 40 per cent. potash salt proved better them kainit as a winter top-dressing.

In sowing clover under spring grain (oats or barley), manuring with potash should not be neglected, as it is important for the cereal and still more so for the succeeding clover. In manuring experiments on permanent pastures and meadows, potash manures have proved especially necessary.

2. *Nitrogen.* — The experiments have confirmed the observation that dunged mangels which received nitrate of soda as well as potash and phosphoric acid made much better use of the potash in the manure and in the soil, and also of the nitrogen in the farmyard manure.

Further experience has been gained as to the good effects of the nitrogen in nitrate of lime.

The effect of cyanamide in these experiments was considerably inferior to that of nitrate of soda or of nitrate of lime. The troublesome dust produced by cyanamide when broadcasted could be avoided by mixing with it 10 to 15 per cent. of iron pan. This also improves its action, as the presence of iron oxide assists in the transformation of cyanamide into urea. This mixture as a top-dressing for winter grain gave an increase in the yield and a better utilization of the nitrogen, *viz.* from 48 to 62, 29 to 59, 37 to 78, 49 to 87, 42 to 57 and 46 to 64 (as percentages) in the various experiments.

Cyanamide freed from carbide by treatment with steam gave a higher yield of grain than ordinary cyanamide in field trials with oats. The same result was obtained by adding organic substances to cyanamide.

Sulphate of ammonia obtained by Haber's process (combination of atmospheric nitrogen with hydrogen to form ammonia) proved equal in field trials to the product of coke and gas works.

The writer has also made observations on the action of a combined dressing of sulphate of ammonia and rock-salt on sugar beets in a very good year and a very bad year. In the good year this mixture gave decidedly better results than nitrate of soda ; in the bad year the weather was very dry till the end of June and the beets developed very late : the result was that the amount of sugar produced on a given area was greater on the nitrate of soda plot.

Among new manures, urea obtained from atmospheric nitrogen, and nitrate of urea, gave good results ; their value was determined partly in field trials and partly in pot cultures. The urea used contained 43 to 44 per cent. of nitrogen, the nitrate of urea 33.60 per cent. In the pot cultures in the summer of 1913 oats were used ; out of 100 parts of nitrogen supplied as manure, the following were recovered in the crop :

Manuring	Soil used: Loam	Soil used: Peat soil
Nitrate of soda	80.5	80.5
Urea	83.5	88.5
Nitrate of urea	94.5	77.0

In experiments with tobacco, nitrate of urea beat all other nitrogenous manures.

Three other compounds built up from atmospheric nitrogen, *viz.* calcium nitrite, aluminium-nitrogen and silicon-nitrogen, turned out to be of little value or quite useless.

In experiments on permanent pastures and meadows, small dressings of nitrogen have sometimes given highly satisfactory results ; but it is not yet clear under what soil conditions such manuring is likely to be successful.

Stimulants (catalytic manures) have also been tried : mixtures of manures with various metallic oxides and salts of metals have sometimes given good results, sometimes none. It appears that different plants behave differently towards these bodies.

607 – **Comparative Effects of Nitrate of Soda and Nitrate of Lime** (1). — CHATEAUCLOS, R. in *Journal d'Agriculture pratique*, Year 78, No. 22, pp. 688-690. Paris, May 28, 1914.

Good results were obtained by using nitrate of lime on certain sandy and granitic soils poor in lime in the departments of Vienne and Haute Vienne.

608 – **The Manufacture of Calcium Cyanamide in Dalmatia** (1). — *Landes-Amtsblatt des Erzherzogtumes Österrich u. d. Enns*, Year 10, No. 9, pp. 69-70. Vienna, 1914.

The manufacture of calcium cyanamide, which is making such great progress in all parts of the world (2) has of late become established also in

(1) Cf. article : " The Use of Artificial Nitrogenous Manures in Austria " by F. W. DAFERT, in *B.* Dec. 1912, pp. 2547-2550.

(2) The estimated output of the world for 1913-1914 was 27 500 tons.

Dalmatia. The cyanamide factories which have been erected in that country derive their power from the falls of the Kerka near Sebenico and of the Cetina near Almissa, not far from Spalato. When completed, the factory at Almissa will produce about 2 ½ times as much as the one at Sebenico. The falls of the Cetina are not inconsiderable, and the driving power developed by the force of the water is thus fairly high ; when the works are completed, there will be annually available about 80 000 HP.

609 - **Austrian Experiments in Inoculating Leguminous Crops with Nodule Bacteria.** — KÖCK, G., in *Monatshefte für Landwirtschaft*, Year VII, Part 1-2, pp. 24-27. Vienna, January-February 1914.

The Vienna Phytopathological Station has carried out, on its experimental grounds in various parts of Austria, experiments in the inoculation of seed with nodule bacteria. The experiments were carried out with serradella, beans, and lupins.

In one case serradella gave the greatest yield of green forage after treatment with Azotogen (1) while in two others Nitragin (2) was the most effective, Azotogen having very little influence. In one experiment Nitragin gave a yield of green food 2 ½ times, and Azotogen twice, as large as that produced by the untreated area. The yield of seed was also, roughly speaking, doubled by the use of either agent as compared with the untreated area. The nodule bacteria from the Institute of Agricultural Botany at Munich also exercised a remarkably beneficial influence on the yield. No influence was observable, as a result of these experiments, from the inoculation on leguminous plants raised the following year on the same land.

With beans and blue lupins no noteworthy results were in either case to be recorded, while in another experiment, part of the blue lupins shewed a considerably increased yield. In this same experiment white lupins did not respond at all to the application of various bacterial cultures.

It is, of course, impossible to generalize from the results obtained, without taking into account the nature of the soil and of the plants grown. Trials on his own land can alone afford the farmer conclusive information as to the economic value of this kind of treatment as applied to the various leguminous crops.

610 – **Composition of Various Starches.** — TANRET, C. in *Comptes Rendus des Séances de l'Académie des Sciences*, Vol. 158, No. 19, pp. 1353-1356. Paris, May 11, 1914.

AGRICULTURAL BOTANY. CHEMISTRY AND PHYSIOLOGY OF PLANTS

The writer observed that all starches contain amylopectin and various amyloses in different proportions. They may also be distinguished from one another by the effect of water on the amylopectin and by the solubility of the amyloses in hot water. Analytical methods are discussed and the composition of various starches is given as follows :

(1) Azotogen cultures supplied by HUMAN and TEISLER, of Dohna.

(2) Nitragin cultures supplied by A. KÜHN'S Agricultural Works, Bonn-on-Rhine.

Amylopectin and amylose content of various starches.

Starch	Amylopectin	Amylose	Starch	Amylopectin	Amylose
Oats	71.5	28.5	Maize	70	30
Banana	79.5	20.5	Barley	73	27
Wheat	67.5	32.5	Pea	78.5	21.5
Chestnut	67	33	Apple	76	24
Broad beans	72	28	Rice	68.5	31.5
Horse beans	76	24	Buckwheat	78.5	21.5
Haricot beans	75.5	24.5	Rye	78.5	21.5
Lentil	73.5	26.5	Potato	73	27

611 – **The Determination of the Quality of Starch in Rice Grains.** – WARTH, F. J. and DARABSETT, D. B. — 1. Disintegration of Rice Grains by means of Alkali, in *Agricultural Research Institute, Pusa, Bulletin* No. 38, pp. 1-9, + plates I-VI. — 2. The Fractional Liquefaction of Rice Starch, in *Memoirs of the Department of Agriculture in India, Chemical Series*, Vol. III, No. 5, pp. 135-146, + I plate. Calcutta, February 1914.

I. Chemical analysis reveals no differences in composition between different varieties of rice such as would account for their differences in hardness, milkiness, and milling qualities. With the object of divising some method of distinguishing the quality of the starch, rather than its quantity, in different types of grain, these investigations on the disintegration of rice grains by means of alkali were commenced. Rice grains immersed in dilute solutions (one per cent.) of alkali show disintegration in a few hours owing to the solution of the protein constituent. At concentrations of alkali of 2 and 3 per cent. the starch granule are attacked and the whole of the grain becomes gelatinised. It was found that the degree of milling or polishing has no effect on the rate of disintegration, but that different varieties show considerable differences.

II. After a series of comparative trials, it was found that immersion in a 1 per cent. solution of potassium hydrate for 24 hours produced satisfactory results without causing appreciable breakage of the starch granules. Various samples of rice were disintegrated in this way, and, after neutralisation, were subjected to fractional liquefaction by conversion of the starch with malt extract at different temperatures. After conversion the solutions were filtered with kaolin to remove the unliquefied granules. The liquefied starch was estimated in an aliquot portion of the filtrate by hydrolysis with hydrochloric acid, the glucose content being determined by Fehling solution using permanganate for estimating the cuprous oxide. The quantities of permanganate required are proportional to the amounts of starch liquefied at a given temperature, and may be used in comparing the qualities of the starch of the different varieties of grains.

The results obtained with various samples of rice are as follows:

1) Glutinous rices contain starch which liquefies appreciably at 60° C. and is almost completely liquefied at 70° C.

2) Hard vitreous rices do not begin to liquefy to any appreciable extent before 65° C. and reach completion at about 75° C. A sudden breakdown of starch takes place between 70° and 75° C.

3) In almost all types of rice there is a residue of 7 or 8 per cent. of more resistant starch which only breaks down gradually.

From these results it appears that the cooking quality of rice is distinctly correlated with its starch quality. Comparisons of the rate of disintegration in alkaline solution show that there exists some correlation between disintegration and starch quality. Further work is necessary to determine the exact relationship between protein content, rate of disintegration and starch quality.

612 – **The Movement of Potash in Plant Tissues.** — MAQUENNE, L. and DEMOUSSY, E. in *Comptes Rendus des Séances de l'Académie des Sciences*, Vol. 158, No. 20, pp. 1400-1404. Paris, May 18, 1914.

Branches of various plants were subjected to electrolysis in a jar containing distilled water in order to dissociate ionisable compounds. The cathode liquid was then examined: more than four-fifths of its contents consisted of potash. The anode liquid on the other hand contained traces of phosphoric acid, and smaller traces still of sulphuric and hydrochloric acids.

613 – **The Action of Manganese on Plant Growth.** — 1. KELLEY, W. P. (The Function of Manganese in Plants) in *The Botanical Gazette*, Vol. LVII, No. 3, pp. 211-227. Chicago, March 1914. — 2. SKINNER, J. J. and SULLIVAN, M. X. (The Action of Manganese in Soils) in *Bulletin of the U. S. Department of Agriculture*, No. 42, *Contribution from the Bureau of Soils*. Washington, April 3, 1914.

Previous experiments on the effect of manganese on plant growth show very variable results. Two views have been put forward to account for the observed effects, *viz. a*) the stimulation of the activity of oxidising enzymes in soils and plant tissues; and *b*) the increased solubility of the mineral constituents of soils. The inadequacy of these views to account for all the facts has led to the present investigations.

1. — *The function of manganese in plants.*

The writer has studied the effect of manganese on plant tissues microscopically and chemically. He finds that changes take place in the protoplasmic contents of the cells of the roots and leaves. Occasionally the protoplasm contracts from the cell walls and the nuclei become brown. In some plants (pineapple) the chlorophyll undergoes decomposition and starch formation ceases. This action is shown to be independent of the activity of the oxidising enzymes. The ash analyses of numerous plants show that manganese is absorbed in considerable quantities, that the ratio of lime to magnesia is increased and that the percentage of phosphoric acid is decreased.

From these results, the writer is led to suggest that manganese affects the permeability of the protoplasm to calcium and magnesium salts and that the consequent change in the rate of absorption of these salts may react beneficially or otherwise according as the ratio of lime to magnesia in the soil is less or greater than that required for maximum growth.

2. — *The action of manganese in soils.*

Experiments were carried out to study the effect on growing crops of adding manganese salts to soils and to water cultures containing aqueous

extracts of soils. The effect in the oxidation of the soil of plots containing growing crops was also determined. The results obtained are summarised as follows :

a) Manganese chloride, sulphate, nitrate, carbonate and dioxide have a stimulating effect when applied to unproductive sandy loam soil. The best results were obtained when the salts were applied in amounts of from 5 to 50 parts of manganese per million.

b) On a productive loam the various salts of manganese had no stimulating effect.

c) The effect of manganese on the oxidising power of the roots and on the general growth of plants growing in aqueous extracts of soils varies with different soils. With poor, unproductive soils, especially those containing harmful organic compounds, the addition of manganese increased oxidation and growth. With productive soils, oxidation was increased but the growth was decreased, probably owing to excessive oxidation.

d) On soils of an acid nature the addition of manganese decreased the oxidising power of the soil and plants as well as the crop production.

e) The oxidising power of a soil depends not so much on the amount of manganese as on its form, and on the nature of the organic matter. Organic matter in a state of autoxidation increases the oxidising action of manganese.

The writers suggest that the beneficial action of manganese in certain soils may be due to its function of aiding and increasing the oxidation and other vital processes in the plant as well as in the soil, and by this means changing or destroying some noxious products detrimental to plant growth.

614 – **Action of Thorium on Seeds.** — MUÑOZ DEL CASTILLO, JOSÉ (Lecture before the Spanish Farmers' Association) in *Boletín de la Asociación de Agricultores de España*, No. 58, pp. 50-56. Madrid, March 1914.

Since 1912, the Radiological Institute of Madrid University has undertaken a series of investigations into the action of radium, thorium, and radioactive manures. By this means it has been confirmed that with regard to increasing the growing-power of seeds, the action of thorium is superior to that of radium as regards cereals and other food-plants, and that plants grown from seed subjected to thorium-radiation possess a stronger growth.

The most complete investigations were made with barley, the seed being placed in two earthenware pots filled with ordinary earth. In one of the pots small particles of thorium ore had been placed beforehand ; the other pot acted as a control. From the seed produced by the pot containing the thorium, other cultures were started in two more pots, one filled with ordinary earth, and the other with similar earth containing thorium ore. The result, which the writer illustrates by means of photographs and a diagram, was as follows : the third generation of barley exposed to the action of the thorium had the leaves so highly developed that it looked like a new variety.

The writer observes that there are plenty of soils possessing radioactivity on account of thorium emanations, and that they ought to be used particularly for seed production. Analysis of soils to determine the presence of this property would therefore be useful.

615 – **Breeding Experiments which Show that Hybridisation and Mutation are Independent Phenomena.** — GATES, R. R. in *Zeitschrift für Induktitive Abstammungs und Vererbungslehre*, Vol. II, Part 4, pp. 209-278, + 25 figs. (article written in English). Berlin, March 1914.

Hybridisation experiments between *Oenothera rubricalyx* and *O. grandiflora* give results wich cannot be interpreted in terms of Mendelian unit-characters. The red pigmentation characteristic of *rubricalyx* is dominant in F_1 and shows segregation in F_2, but the ratios of pigmented to unpigmented offspring were different in different families. It is therefore concluded that different F_1 individuals possess different *degrees of prepotency* as regards the percentage of pigmented plants in their offspring. Crossing back the F_1 with either parent produced offspring of a darker or lighter shade respectively, showing that the amount of pigment produced by the individual cells is *quantitatively* inherited.

The characters for height were inherited according to the ratio 3 tall : 1 dwarf in one family and 1 tall : 2 dwarf in another. When the reciprocal cross was made the ratio was 7 : 1. These results can only be accounted for by assuming different degrees of prepotency in different F_1 individuals.

The numerous differences in foliage, buds, pubescence and in physiological development between *grandiflora* and *rubricalyx* are non-Mendelian or blending characters. In all these cases there is neither dominance nor segregation, but every conceivable degree of intermediacy is represented.

From these and other results the writer concludes that the Mendelian conception of fixed and unmodifiable unit characters which can be redistributed and shuffled regardless of the organisms themselves which exhibit these characters, is unsound, for the individual organism is the real unit. The presence-absence hypothesis implies a misconception of the nature of the differences between alternative characters, and of their interactions with each other.

Various mutants and aberrant forms occurred among the above hybrids. One of these, known as *lata rubricalyx*, was examined cytologically and was found to contain 15 instead of the usual 14 chromosomes. This work will be described elsewhere.

616 – **A Case of Correlation in Wheat.** — PARKER, W. H. in *Journal of Agricultural Science*, Vol. VI, Part II, pp. 179-181. Cambridge, May 1914.

In investigating the variation of the density of ear in a variety of wheat (Squarehead's Master) a striking case of correlation was observed between the average length of internode of the ear and its total length. The average internode-length is obtained by dividing the total length of rachis in millimetres by the total number of internodes. Measurements were made of the main tiller of 1887 plants and the calculated correlation coefficient

proved to be 0.9099. Considering the very small deviation of the actual internode-lengths compared with those estimated, the use of the more easily determined total rachis-length as a measure of the density of ear would appear to be justifiable. The writer also considers that the relation between internode-length and rachis-length would be a more satisfactory basis for the classification of wheats according to the density of their ears, than that of the internode-length as used by NILSSON-EHLE, or the method of grouping them into classes by eye alone as is done at Svalöf.

617 – **Rice Breeding in Java** (1). — VAN BREDA DE HAAN, J. in *Bulletin économique de l'Indochine*, Year 16, No. 100, pp. 11-28. Hanoï, January-February 1913.

6400 samples of paddy were collected from various parts of Java for trial at the " Research Laboratory for Rice and Other Crops. " They were first separated into two divisions by staining sections of the grains with dilute iodine solution, which turns *Oriza sativa* a dark violet and *O. glutinosa* a red brown. They were further subdivided under the following headings: 1) dark glumes and awns ; 2) red awns ; 3) yellow awns and 4) awnless, and in each division the varieties were classed according to the colour of the grain and the length of the awn. In this way 715 groups were established for *O. sativa* and 41 for *O. glutinosa* and each group was provided with a genealogical register on which the external characters of the group were entered, particular note being taken of the appearance of hairs on the nodes and of the size and surface of the ligule.

The more promising varieties were subjected to pedigree culture with good results, and under these conditions a yield of 76 pikols per bouw (5900 lbs. per acre) was obtained from Tanggerang rice, which was imported from Carolina fifty years ago. In order to extend these results to other conditions of soil, climate and irrigation, it is proposed to establish seed gardens in other parts of the Island.

Hybridisation experiments are also being carried on, but good results are reached more slowly than with the method of selecting and breeding pure lines, on account of the difficulty of isolating constant types.

At Buitenzorg rice flowers open from 6 a. m. to 3 p. m., being most active from 10 a. m. to noon. The flowers on a panicle do not all open at the same time : in fact a panicle may take up to six or ten days to open all its flowers.

In the course of the experiments, it was found that the heaviest grains are usually situated in the uppermost third of the panicle, that the heaviest grains could not be detected with certainty by the immersion method and that density of grains used as a factor in selection gave very irregular results.

618 – **Tobacco Breeding in Java.** — HONING, J. A in *Mededeelingen van het Deli Proefstation te Medan*, Year VIII, No. 5, pp. 135-153. Medan, March 1914.

An account is given of tobacco breeding in the two centres of production in Java, — Djember and Klaten.

At Djember tobacco is cultivated up to an altitude of 1800 ft., and a

(1) See also No. 27, *B.* Jan. 1913; No. 120, *B.* Feb. 1913. (*Ed*).

large number of varieties are required to fit the changing climatic conditions. The most popular variety comes from Deli, but this is not sufficiently hardy to be cultivated above 200 to 300 ft. and has to be replaced by a Kadoe variety, which is more resistant but of inferior quality. By crossing the two varieties, a hybrid has been obtained possessing the good qualities of both parents ; crosses of a Japanese variety, Hatano, with the Kadoe variety have also yielded hybrids but of inferior quality.

The breeding work has hitherto been done by the planters themselves; they raise fresh hybrids every year employing native women to carry out the manual labour. Recently an experimental station has been created which will take charge of the breeding work and attempt to isolate a suitable type of plant instead of having to raise hybrids every year.

At Klaten the experimental stations have chiefly sought to improve tobacco by selection. Several cultivated varieties were investigated and two types known as the Y and the Kanari were isolated and gave very satisfactory results; unfortunately their very uniformity proved a disadvantage on the market accustomed to a more varied product, and experiments, are now being made to produce varieties which will comply more fully with the market requirements.

619 – **Impurities in Seeds in Victoria, Australia.** — *Communicated by* S. S. CAMERON, *Director of Agriculture.* AGRICULTURAL SEEDS

Report on seed examined in March 1914.

Variety of seed	Country of origin	Weed seeds		Percentage of non-germinable seed	Percentage of diseased seeds	Quantity examined	Remarks
		Species	Percentage				
Millet Seed (*Panicum* sp.) . .	Turkey	Nil	Nil	8	Nil	3 oz.	A small percentage of grit and loading. This has been imported for birds' food.

620 – **Effect of Low Winter Temperatures during 1913-1914 on Wheat in the Ardennes.** — DENAIFFE in *Journal d'Agriculture Pratique*, Year 78, No. 20, pp. 620-621. Paris, May 14, 1914. CEREAL AND PULSE CROPS

A large number of varieties of wheat growing in the experimental fields of Carignan (French Ardennes) were exposed to very low temperatures during the winter 1913-1914. From December 27 to January 10 the plants were protected by a covering of snow, but from January 10 to 19 they were exposed to temperatures of — 18° to — 20° C. (0° to — 4° F.) without a single thaw. The proportion of plants destroyed by the frost was recorded and varied from 0 to 80 per cent.

621 – **Manurial Experiments on Malting Barley carried out at the Vienna Experimental Station.** — DAFERT, F. W. in *Monatshefte für Landwirtschaft*, Year VII, Nos. 1-2 and 3-4, pp. 5-19 and 50-58. Vienna, January-February and March-April 1914.

In 1906 manurial experiments were carried out witth malting barley at the Vienna Experimental Station in order to determine the effect of application of phosphoric acid on the yield and quality of the grain. The experiments consisted of a series of 46 trials, in which plots were dressed with superphosphate at the rate of 180 lbs. per acre; all plots were duplicated. The average results were as follows:

Plot	Mean of 46 trials		Mean of 27 trials	
	Grain in lbs. p. acre	Increase due to manure, lbs. p. acre	Percentage of nitrogen in grain	Difference between manured and unmanured grain
Unmanured	1 919	—	9.38	—
Superphosphate	2 044	125	9.44	+ 0.06

The application of superphosphate produced no very marked influence on the yield, while the difference in nitrogen content between the manured and unmanured grain was less than that between the seed and the harvested grain, which was estimated in 28 trials and amounted to 0.61 per cent., showing that climatic conditions are more important than manurial treatment with regard to the composition of the grain. When the barleys obtained were grouped according to the phosphoric acid content of the soils in which they had been grown, the following results were obtained:

No. of trials	Percentage of phosphoric acid in soil	Increase in crop due to superphosphate, lbs. per acre
5	over 0.2	145
9	0.15 to 0.2	123
21	under 0.15	79

These results are unexpected, inasmuch as the soils richest in phosphoric acid have apparently profited most by the dressing of superphopsphate. Similar results have already been obtained in other places, but they cannot be considered as generally applicable.

622 – **Influence of Potash and Phosphoric Acid on the Quality of Malting Barley.** — SCHÜL, L., in *Landwirtschaftliche Jahrbücher*, Vol. XLV, Part 5, pp. 641-712. Berlin, 1913 (Published January 15, 1914).

The experiments here described were made by the writer on the experimental ground of the Agricultural Institute at Giessen University in 1909. The soil is a fairly strong loam, is drained, and stands at 500 ft.; the average rainfall is 550 mm. (22 in.); the previous crop was winter wheat.

The subject of the experiment was a barley of the Imperial type, called New Burton Malting. The barley was drilled in on the 10th of April, in rows 9 in. apart. On the 26th and 27th of April a mixed potassic and phosphatic dressing was applied. To ascertain whether the substances under investigation were present in the minimum amounts required by the crop they were applied in three progressiveley increasing quantities:

	40 per cent potash salts	Superphosphate (18% water-soluble phosphoric acid).
	cwt. per acre	cwt. per acre
Light dressing	0.4	0.8
Medium »	0.8	1.6
Heavy »	1.6	3.2

By combining the above quantities, fifteen different dressings were obtained.

3 potash alone: light, medium, and heavy.
3 phosphates alone: » » » »
3 combining a light potash dressing with each of the 3 strengths of phosphates
3 » » medium » » » » » » » » »
3 » » heavy » » » » » » » » »

In addition, there were 5 plots with no manure, and the whole was run in duplicate, making a total of 40 plots, each measuring 12 sq. yds. To ensure the action of the potash and of the phosphoric acid, a dressing of 2.4 cwt. of nitrate of soda was applied to the manured plots on the 30th of April. All the manures were hoed in and the plots raked over. The whole experimental area had been limed with 16 cwt. per acre of 96 per cent ground quicklime.

The weather began by being cool in April, was finer and warmer in May, then became cool and wet for the first three weeks of June, but the temperature reached summer level for the last ten days; July, however, was cool and rainy, and heavy rain at the end of the month lodged some of the barley. The crop was harvested dead-ripe on the 14th of August. No definite statement can be made as to any difference in the ripeness of the various plots, but the results of analysis seem to point to there having been such a variation.

The corn was threshed and the yield ascertained on the 18th and 19th of August. The judging of the quality, which was not carried out till June 1910, had reference to: protein and water content, weight of grain, evenness of the sample, fineness of the husk, colour, germinating capacity and energy, impurities, damaged grain, sprouted grain, foul odour.

The writer obtained the following results:

1. In every case the soil profited by a phosphatic dressing, which caused a fuller utilization of nitrogen and potash. A quite remarkable demand for potash was observed to be brought about by the medium and strong dressings of phosphates.

2. The potash-phosphate dressings always effected an increase in the gross yield.

3. The use of 40 per cent. potash salts and of superphosphates as a top-dressing proved suitable.

4. The pretein-content, which was very high on account of the nitrogenous dressing, was decreased by the application of combined potash and phosphates and this decrease corresponded to the increase in the yield.

5. The proportion of dry matter shows a nearly regular increase with the use of combined potash and phosphates, independently of the yield. It was not possible to find out whether this is due solely to a more advanced stage of ripeness, owing to the better nourishment of the barley, or to a larger deposit of potash and of phosphoric acid in the grain. In cases where no increase in yield was found on plots with heavy potash dressings and phosphoric acid, as compared with those with moderate potash dressings, a superfluous consumption of potash is to be assumed.

6. Not regularly, but still in the majority of cases, the double dressing gives an increase in 1000-grains weight and in the size of the grains, and a decrease in the proportion of husk.

7. Increase of the 1000-grains weight is generally accompanied by increase in the number of grains which will not pass through a 2.8 and a 2.5 mm. sieve. The weight of husk varies inversely.

8. Combined potash and phosphate manuring improves appreciably the germinating capacity and more still the germination energy.

9. Barley dressed with potash and phosphoric acid has nearly always a canary-yellow colour.

The writer concludes that in order to obtain a high-class sample, nitrogen should be present in as small a proportion as possible. If a maximum yield and the highest quality are incompatible, it is none the less possible, up to certain point, to obtain by means of a nitrogenous manuring an increase in yield without injuring the quality. The attainment of this point depends essentially on the quantity of potash and phosphoric acid employed. In discussing his results the writer quotes those obtained by several other investigators.

FORAGE CROPS. MEADOWS AND PASTURES

623 – **Argentine Lucerne Seed.** — *Dirección General de Agricultura y Defensa Agrícola, Boletín del Ministerio de Agricultura,* Vol. XVII, No. 1, pp. 82-89 + 3 coloured plates. Buenos-Aires, 1914.

At the present time, Argentina produces all the seed necessary for her great crops of lucerne, and will be able, at no distant date, to become an exporter. The quality, however, does not correspond to the increase in quantity, since the seed leaves a great deal to be desired in the way of purity, absence of dodder and germinating capacity. But on the other hand the native seed gives more hardy and lasting plants than any imported variety.

The seed from the irrigated districts of Mendoza, San Juan, La Rioja, part of San Luis, north of Córdoba, Salta, Jujuy and Catamarca, generally contains a large amount of dodder (*Cuscuta corymbosa* R. et P. and a variety of *C. racemosa* Mart.) and seeds of *Melilotus parviflorus* Desf., and sometimes

a large quantity of *Lippia nodiflora* Rich., *Schkuhria bonariensis* Hook., *Bidens leucanthus* Wold., *B. scabiosoides* H. et Arn.., *Panicum colonum* L., *Chenepodium opolifolium* Schr., *Madiola latoritia* Schm., *M. malvifolia* Gr., *Anoda triangularis* Db., and *Sida rhombifolia* L. The seeds of this last species constitute, together with those of dodder and melilot, a real menace to farming. *Sida*, being perennial, is difficult to destroy.

Another serious drawback to native seeds is the presence of hard grains, 50 per cent on an average, only half of which are capable of germinating, the other half being pure loss.

In a second area, comprising the south of Córdoba, part of San Luis, the north of the Pampa, the west and north-west of Buenos-Aires and the department of San Rafael de Mendoza, the seeds of lucerne are less well developed, and in some cases, as at San Luis, very small indeed, although well shaped. In this area there is less dodder, but there are usually several other extraneous seeds: *Chenopodium, Amaranthus, Cnicus, Centaurea, Anthemis, Plantago, Rumex*, etc. Hard seeds occur in a proportion of 25 per cent. The germinating capacity is undoubtedly superior and the plants produced last a long time and resist drought well.

To the third area belong the south of Buenos-Aires, Rio-Negro and Chubut. The seeds from there are fairly popular, both on account of their size and on account of the small quantity of extraneous seeds present. There are, however, 50 per cent. of hard seeds in the two latter provinces, and 30 per cent. in that of Buenos Aires. Dodder is not often found.

To sum up, it may be said that Argentine lucerne seed grown without irrigation surpasses in germinating capacity all the foreign varieties of lucerne, but that it has nevertheless the following faults:

1. It is impossible to obtain large quantities of good seed of even quality.

2. A large proportion of the native seed is so impure that diligent cleaning would be required before it could be sown; but this cleaning cannot be effected, owing to the small difference in price between good and bad seed, and because purchasers prefer a low price without troubling about quality.

3. A large quantity is found of the seeds of *Cuscuta racemosa* Mart., and of *C. corymbosa* R. and P., the size of which makes it impossible to separate them from the lucerne seed.

4. A large quantity of hard seeds are present; these cause a considerable reduction in the germinating capacity and energy.

To obviate these faults, it would be necessary: 1) for the producers to eradicate weeds in the lucerne fields, abandoning those fields which cannot be cleaned; 2) for the purchasers to pay attention to buying good, well-cleaned samples of seed instead of seeds offered at a low price.

624 - **Determination of Certain Species of *Carex* by their Vegetative Characters.** — KUSNEZOV, W. in *Bulletin für angewandte Botanik*, Year 7, No. 1 (65), pp. 18-41 + 10 plates. St. Petersburg, January 1914.

The writer has prepared the following schemes for the determination of species of *Carex*.

A. *Determination of the ten chief species of Carex growing in swamp-meadows by field examination of the vegetative parts.*

1. The plants form dense or more or less open clumps 2
   Plants with creeping stems, not forming clumps 6
2. Very open clumps, not forming tussocks. 3
   Dense clumps, forming more or less well-developed tussocks 4
3. Membrane of the leaf-sheath veined, wearing to a delicate filamentous network *C. paludosa* Good.
   Membrane of the leaf-sheath veinless, not wearing to a network . . . . . *C. acuta* L.
4. Membrane of the leaf-sheath veined, wearing to a delicate filamentous network *C. stricta* Good.
   Membrane of the leaf-sheath veinless, not wearing to a network 5
5. Cross-section of upper part of leaf-blade showing reflexed margins . . *C. vulgaris* Fries.
   Cross-section of upper part of leaf-blade semicircular or channeled without reflexed margins . . . . . *C. paradoxa* Willd.
6. One side of the leaf-sheath forming a thin, semitransparent, whitish membrane . . 7
   All three sides of the leaf-sheath thick, foliaceous, green . . . . . *C. disticha* Huds.
7. Membrane of the leaf-sheath veined, wearing to a filamentous network 8
   Membrane of the leaf-sheath veinless, not wearing to a network 9
8. Leaves soft, whitish within . . . . . *C. ampullacea* Good.
   Leaves rigid, bright green within . . . . . *C. vesicaria* L.
9. Plant greyish-green or bluish-green . . . . . *C. panicea* L.
   Plant green or yellowish-green . . . . . *C. teretiuscula* Good.

B. *Determination of the ten chief species of Carex growing in swamp-meadows by examination of the vegetative parts in hay.*

1. One side of the leaf-sheath forming a thin, semitransparent, whitish membrane . . . 2
   All the sides of the leaf-sheath thick, foliaceous, green . . . . . *C. disticha* Huds.
2. Membrane of the leaf sheath veined, wearing to a filamentous network 3
   Membrane of the leaf-sheath veinless, not wearing to a network 6
3. Leaf-blade soft, whitish within . . . . . *C. ampullacea* Good.
   Leaf-blade stiff, green or greyish-green within 4
4. Leaf-blade bluish-green below . . . . . *C. paludosa* Good.
   Leaf-blade greyish-green or light green below 5
5. Leaf-sheath tinged with reddish . . . . . *C. vesicaria* L.
   Leaf-sheath light or dark brown . . . . . *C. stricta* Good.
6. Cross-section of leaf-blade channeled, the central and upper parts with reflexed margins 7
   Cross-section of leaf-blade channeled or semicircular, without reflexed margins . . 9
7. Leaf-blade bluish-grey-green or bluish-grey . . . . . *C. panicea* L.
   Leaf-blade green, greyish-green or yellowish-green, not blue grey 8
8. Upper part of leaf-blade with slightly reflexed margins . . . . . *C. acuta* L.
   Upper part of leaf-blade with strongly reflexed margins. . . . . *C. vulgaris* Fries.
9. Ligule continuous with the top of the leaf-sheath membrane, the two forming a collar round the stem or the shoot . . . . . *C. teretiuscula* Good.
   Ligule distinct from the leaf-sheath membrane, not forming a collar . *C. paradoxa* Willd.

625 – **Large Scale Field Trials with Mangels.** — VON RÜMKER, K., and ALEXANDROVICH, J., in *Landwirtschaftliche Jahrbücher*, Vol XLV, Part 4, pp. 503-596 + 6 figs. Berlin, December 23, 1913.

In 1912 the writers carried out field trials on a large scale in collaboration with R. Leidner, K. Schröter and O. Bormann, with 35 different varieties of mangels. Six plots were devoted to each variety and the seed was drilled in. The yield, percentage of dry matter, and sugar-content were ascertained, and a description of the quality and quantity was given in the report. In working out the results, experimental errors were reduced by algebraic compensation.

On completion of the experiments, the writers make suggestions for the profitable carrying out of large scale field trials. The object of the investigations is to classify more exactly, according to quality and quantity, the numerous varieties on the market. The more direct testing of each individual variety composing a group which the large scale field trials seem to point to as suitable for certain conditions, must be left to the farmer. Trials covering one year only, but embracing a wide variety of soils and climates, carried out in different districts and repeated periodically, are more satisfactory than large scale trials lasting over several years in the same district, especially on account of the greater rapidity with which information can be obtained by the former method.

626 – **Studies in Indian Cottons. Part I: the Vegetative Characters.** — LEAKE, H. MARTIN, in *Memoirs of the Department of Agriculture in India, Botanical Series*, Vol. VI, No. 4, pp. 115-151, + 3 maps + 9 plates. Calcutta, February 1914. FIBRE CROPS

Studies of the vegetative characters of Indian Cottons have been in progress in the United Provinces since 1905.

As a result of these and other studies of various herbarium collections the writer classifies the various types as follows.

MONOPODIAL.

Perennial ; secondary branches ascending sharply at an acute angle. Leaf factor (1) less than 2 ; plant almost glabrous. Bracteoles small, triangular ; margin entire or dentate. Corolla yellow.

Gossypium obtusifolium (Roxburgh *Flora Indica*) Gammie and Watt . . . . . Type 1.

Perennial ; secondary branches spreading . Leaf factor less than 2. Stem and leaves densely covered with short hairs. Bracteoles deeply auriculate or reniform, deeply serrate, spreading in fruit. Corolla yellow, petals small. Stigma heavily glandular. Capsule inflated and nearly spherical with a sharp mucronate apex.

G. herbaceum (Linn.) Todaro and Gammie, and *G. obtusifolium* var. *Wightiana* Watt . . . . . Type 2.

(1) It may be defined as the ratio of the length of the middle lobe to its greatest breadth. For explanation see *Journal of Genetics*, Vol. I, No. 3, pp. 220. (*Ed.*).

Perennial "tree cotton"; secondary branches ascending sharply at an acute angle. Entire plant deep red or purple. Leaf factor greater than 3; frequently an extra tooth on one or both sides of the central lobe. Bracteoles small, triangular; margins entire or with the tip dentate. Corolla deep red. Stigma eglandular. Capsule usually 3-celled, ovate.

G. arboreum (Linn. sp. Pl.) Parlatore and Todaro, and *G. arboreum* Gammie and Watt . . . . . Type 3.

Plant tall with long monopodial branches sharply ascending. Leaf factor greater than 3; leaf wrinkled. Leaf and stem covered with short hairs. Bracteoles triangular with margin dentate. Flowers yellow or white.

The commonest form of this group possesses the habit and shape of bracts of Type 3, with the wrinkled leaf and short hairs of Type 2. It comprises the *G. intermedium* of Gammie.

Sympodial.

Annuals with few or none of the lowest secondary branches monopodia, the remainder sympodia; monopodial branches ascending and sympodial spreading.

Plant tall, drooping later under the weight of fruit. Leaf large, factor less than 2; lobes 3 or with 2 small accessory basal lobes. Young stem and leaves sparsely hairy. Bracteoles small, entire or with few small apical teeth, closely enveloping bud and fruit. Corolla yellow with deep red "eye". Petals large, semi-transparent. Stigma eglandular or with few glands only. Capsule 3-celled ovate.

G. indicum (Lamk.) Gammie, and *G. Nanking* var. *bani* Watt. Type 4.

Plant erect, drooping later. Leaf factor less than 2; lobes 5-7. Young stem and leaves hairy. Bracteoles large, entire or with a few small apical teeth, loosely enveloping bud and in fruit sometimes reflexed. Corolla yellow with deep red "eye"; petals opaque. Stigma eglandular, or few glands only. Capsule 3-4 celled, ovate. . . . . Type 5.

Plant erect, differing from Type 4 in greater rigidity of main stem and greater angle at which secondary monopodia arise (about 45°), and in the white corolla. Petals small, scarcely projecting beyond the bracteoles . . . . . Type 6.

Plant erect, secondary branching monopodial, when developed, sharply ascending. Leaf factor less than 2; flower white. The plant is strongly asymmetrical and the vegetative period very brief, the first flowers developing while the plant is quite small. Growth continues throughout the season, the plant maintaining a marvellous fertility. . . . . Type 7.

Plant tall, drooping later. Leaf factor greater than 3; lobes 5-7 with an extra tooth on one or both sides of the central lobe frequently developed. Young stem and leaves hairy. Bracteoles entire or with few apical teeth. Corolla yellow with deep red "eye". Stigma eglandular or with few glands only. Capsule 3-4 celled, ovate. . . . . Type 8.

Plant differing from above only in the colour of corolla which is white and scarcely protrudes beyond the bracteoles . . . . . Type 9.

Types 4-9 belong to the *G. neglectum* and *G. roseum* of Todaro, the *G. neglectum* (Tod.) of Gammie and the *G. arboreum* vars. *neglecta* and *rosea* of Watt.

Plant tall with main stem weak and early drooping. Leaf factor greater than 3 ; lobes 5-7. Bracteoles entire or with few apical teeth, large and continuing to grow with the developing boll. Corolla pale yellow with deep " eye ". Stigma eglandular. Capsule ovate, very large with numerous seeds. *G. cernuum* of Todaro and Gammie and *G. arboreum* var. *assamica* Watt. . . . . Type 10.

Plant tall. Leaf factor greater than 3 ; lobes 5-7 ; stem and leaves of a deep red or purple colour ; bracteoles entire or with few apical teeth. Corolla with deep red " eye "; petals white, tinged with pink along margin and the portions exposed in the bud.

G. sanguineum Hassk. var. *minor* Gammie . . . . . Type 11.

Plant small, with monopodial secondary branches few or none. Leaf factor less than 2 ; lobes 3-5. Flower yellow. Boll large. Includes types from China.

Corolla yellow-eyed; seed with fuzz . . . . . Type 12.
» » » » naked . . . . . Type 13.
» without eye; seed naked . . . . . Type 14.

Plant differing from Type 2 in the character of the secondary branches. This group includes a complex series of forms from Persia. The simplest form is the true *G. herbaceum*, Todaro.

G. hirsutum Linn. This plant, which yields the bulk of the American cotton crop, has formed the basis of numerous experiments in India.

G. Stocksii Max. Mast. A wild form of *Gossypium* found on the limestone hills around Karachi.

Pollination. — The cotton flower is hermaphrodite and self-fertilisation is effective in almost every case. Experiments in cross-fertilisation show that the different forms of *Gossypium* fall into two marked groups, the members of which are fertile *inter se* but completely sterile between the two groups. These groups are characteristic of the Old and the New World and are respectively characterised by united and free bracts.

The colour of the corolla. — The colour of the petals may be yellow, white or red. The latter colour is only found in Types 3 and 11 and extends to the sap. Two forms of yellow are readily distinguished, *viz.* ' yellow ' and ' pale-yellow '.

Breeding experiments show that yellow is dominant both to pale-yellow and to white. The inheritance of the pale-yellow factor is under further investigation.

The ' eye ' of the petal. — All true Indian cottons possess an eye situated at the base of the petal. In some Chinese forms the petal is self-coloured

yellow, and crosses between these forms appear to show that the 'eye' - factor is dominant, though in one case an intermediate form of eye appeared and has bred true to this condition. This constitutes; therefore, a further type.

The red colouring matter in the sap. — The presence of red colouring matter in the sap entirely masks the true petal colour. The true petal colour can only be directly determined in cases of diseased flowers or such as open out of season. The factor for red-coloured sap appears to be dominant over its absence, though the intensity of the colour is diminished and the petals attain a condition known as ' red on yellow ' when the cross is made with a yellow-flowered plant.

The type of branching and the length of the vegetative period. — The axil of the leaf of the cotton plant contains two buds, one main bud to which the second is accessory. Vegetative growth is effected by the development of a monopodium from either of these buds, reproductive growth only by the development of a sympodium from the former. Therefore according as the main bud develops into a sympodium or a monopodium, so will the appearance of the first flowers be accelerated or retarded ; in other words the length of the vegetative period is controlled by the form of the secondary branches. In pure monopodial types even the ultimate secondary branches are monopodial. In sympodial types generally a few of the lowest secondary branches are monopodial. In hybrids between these forms every gradation is found and the change from the sympodial secondary branching to the lower monopodial branching is so abrupt that the character can be conveniently expressed as the percentage of the stem bearing monopodial branches. In actual practice, however, growth does not continue sufficiently long to enable this character to be determined accurately. The length of the vegetative period is therefore made use of in this connection. Determination of the correlation coefficient between the type of branching and the vegetative period gave 0.6628 and 0.8589 for different series.

Crosses between sympodial and monopodial types give F_1 generations with a vegetative period intermediate between those of the two parental types and approximating in a greater or less degree to that of the sympodial parent. The F_2 generation form a continuous series showing every degree of length of vegetative period, but, though the full sympodial type appears comparatively frequently, the full monopodial type only rarely or never does so. In the F_3 generation the average length of the vegetative period of a family approximates to that of the F_2 parents.

Conclusions. — Up to the present these studies have been confined to factors of considerable, though only indirect, importance. The more intricate task of studying the commercially valuable portion of the crop is the subject of further investigations.

627 – **Oils in the Seeds of *Dumoria Heckeli* and *Baillonella toxisperma* Pierre.** — DE WILDEMANN, E. in *Bulletin de l'Association des Planteurs de Caoutchouc*, Vol. VI, No. 4, pp. 81-83. Antwerp, May 1914.

Dumoria Heckeli (1), found on the Ivory Coast by CHEVALIER is native of tropical virgin forests. Its seeds yield a semi-solid oil, snow white when fresh, with a pleasant sweet flavour and slightly aromatic, at the rate of 16.5 per cent. of the seeds or 33.25 per cent. of the kernels.

Baillonella toxisperma Pierre, or *Mimusops Djawa* Engler, has been recently found in the Mayumbe district of the Belgian Congo. It yields a white aromatic oil at the rate of 56.04 per cent. of the kernels or 40.60 per cent. of the seeds.

Both residual cakes are unfortunately toxic on account of the presence of a glucoside of the saponin group, but they may be employed as manure, for they contain a considerable amount of potash and nitrogen (2 and 3 per cent. respectively) though very little phosphoric acid (*Dumoria Heckeli* 0.76 per cent.).

628 – **The Improvement of Indigo in Bihar.** — HOWARD, A. and HOWARD, G. L. C. in *Bihar Planters' Association Bulletin*. Calcutta, 1914.

The cultivation of Java Indigo (*Indigofera arrecta* Hochst.) in Bihar has rapidly declined since 1910, owing to the increasing prevalence of a so-called disease which prevents seed formation. The disease appears towards the end of the monsoon and is characterised by a great reduction of leaf surface and a change in the colour of the remaining leaves to a yellowish green slaty colour. Cultivation experiments have shown that this diseased condition of the plant is due to long continued wetness of the soil, which leads to the destruction of the young feeding roots, followed by leaf-fall and more or less complete wilting of the plant.

This wilting can be checked for a time if the plants are only pruned at the first cut, leaving one branch, instead of being completely cut back. The process is more conducive to normal growth and results in an increase in the total crop.

After the second cut in an ordinary monsoon the crop ceases to be profitable and should be dug up to make room for *rabi* crops.

The growth of indigo for leaf and for seed should be regarded as separate things and seed should not be raised from the old plants which have been cut for leaf. The best method of obtaining good seed of Java indigo is to sow the crop in lines about 24 inches apart in the middle of August on high-lying. well drained fields which are in good heart. After gathering the seed the crop can be grown on for leaf during the next monsoon. Being thdeep rooting plant, the surface soil may be harrowed and the weeds a stroyed with great benefit to the plant. When wheat is grown as a oever crop an early maturing variety with little foliage and stout straw gives the best results.

Selection. — Owing to the frequency of cross-pollination the ordinary-

(1) See FOURNIER, J. *Etude pharmacologique des graines du Dumoria Heckeli et du Baillonella toxisperma Pierre.* Clermont Ferrand.

methods of single plant selection cannot be applied to this crop. Further, the method of estimating the indican-content is too difficult and expensive to be employed in selection experiments. Selection must therefore be confined to those individuals in the mixed crop which grow rapidly and strongly and which by their habit of growth and amount of leaf surface are likely to give the highest yields of leaf. A process of roguing will be necessary to remove all undesirable types and prevent their crossing with the better types. Similar methods require to be applied to the ordinary Bihar indigo (*I. sumatrana*), and a reliable system of seed distribution remains to be established.

RUBBER, GUM AND RESIN PLANTS

629. – **Hevea in Cochinchina.** — GIRARD, M. E. in *Bulletin Economique de l'Indochine*, Year XVII, No. 106, pp. 46-53. Hanoï, January-February 1914.

Effect of the dry season on Hevea plantations. — The dry season is in no way unfavourable to the growth of hevea in the deep soils of Cochinchina, more especially if the soil surface is kept stirred during the wet season so that the rainfall is absorbed. In one year in which the dry season extended over five or six months, the average circumference of trees increased 4 to 6 in. in certain groups, while individual increases amounted to as much as 7 in. The dry season is moreover eminently useful in checking the development of fungoid diseases, especially *Fomes semitostus*.

Contrary to results obtained elsewhere, the dry season apparently has a very favourable effect on the yield of latex. During November, December and January the highest yields are obtained, reaching in the latter month as much as 50 per cent. more than the average for the rainy season. When vegetation becomes active again the yield decreases rapidly and tapping is suspended.

Tapping lasts about 300 days, during 180 to 200 of which the yield is approximately equal to that obtained in the Malay States, whilst during the 100 to 120 days at the height of the dry season the yield is considerably higher.

Capacity of Annamite labour. — The skill and rate of working of the tappers gradually improved, so that the number of trees tapped per head rose from 125 to 400 per day. Further, each man, besides making three excisions on every tree, wetted the cuts, collected the latex and the scrap, carried the latex to the factory and cleaned all recipients employed. When the price of rubber went down, the process was simplified by suppressing the use of water on the cuts, with the result that each man was able to undertake 600 trees and each woman 450 trees per day; these figures represent averages for all the coolies over a period of several months and are important, as three-quarters of the expenses of production are represented by the cost of tapping. The writer considers that the suppression of watering will not only economise labour, but also prove beneficial by causing the latex to be less diluted and the rubber of better quality.

Advantages of smaller excisions. — After numerous experiments, the method of practising three excisions, 18 in. apart vertically, and only engaging one-fifth of the circumference of the tree, has been adopted, as the longer

rest gives the wound a better chance of healing, while the yield is increased or at any rate in no way decreased by limiting the tapping area.

630 – **Influence of the Partial Removal of the Bark on the Yield of Latex** in ***Manihot Glaziovii*** (1). — ZIMMERMANN, A. in *Der Pflanzer*, Year X, No. 4, pp. 180-188. Daressalam, April 1914.

Experiments carried out at Amani and Victoria have shown that the partial or total removal of the bark of *Manihot Glaziovii* increases the production of latex. Of the two methods, the partial removal is more to be recommended, not only because it has a better effect on the yield of latex, but also because it requires less labour and is less liable to damage the tree.

631 – **The Industrial Uses of Maize when Cultivated for Sugar.** — BOYER, L. in *La Sucrerie Indigène et Coloniale*, Year 49, Nos. 10. 11, 13, 17, pp. 226, 252, 299, 343, 392. Paris, March 11 to April 29, 1914 (2). SUGAR CROPS

After a short account of the history of the subject, the influence of castration on the sugar content of maize juice is discussed. Of all known varieties the Giant Servian is the one which has the richest juice in sugars, but JU MELLE has also reported a variety from the Ivory Coast which yielded, with male castration alone, a juice containing 10.49 per cent. of saccharose and 1.23 per cent. of glucose, whilst the male castrated Servian variety only yielded 9.68 per cent. of saccharose and 1.32 per cent. of glucose.

The production of sugar from the juice has still to overcome certain practical difficulties. The ordinary process of extraction in use in sugar-beet factories only results in about half the saccharose being obtained in the form of crystallised sugar from a juice of 59 per cent. purity. The residual molasses contain a high percentage of glucose and are approximately of the same quality as molasses from refineries; they could be profitably used by working them up with the fibrous residues into stock food at the sugar factory itself, the food value of such a product being estimated on the basis of food values in straw. Or a still better use might be to reduce the stalks to a fine meal after a preliminary drying, and put the product on the market either in the pure condition or mixed with various other meals to increase its nitrogenous content and make it into a better balanced food. As the maize would be harvested during the warmest season of the year the stripped stalks could quite well be set up in sheaves to dry, so that their water content should be reduced to 15 to 20 per cent.

As raw material for the manufacture of denatured alcohol, maize is superior to beets both with regard to the produce obtained per ton of treated substance and to the possible profits. In comparing Giant Servian maize with beets of a corresponding sugar content, the value of the maize works out at 3*s* 9*d* per ton more than that of the beets; moreover the distillery residues of maize can be sold to paper works at 3*s* 6*d* per ton, while the beet pulp is only worth 2*s* 6*d* per ton.

(1) See ZIMMERMANN A., Der Manihot-Kautschuk, p. 176. (*Ed.*).
(2) See No. 512, *B.* May 1913. (*Ed.*).

632 – **Comparative Water Absorption of Sugar Cane Plants when Suffering from Sereh Disease** (1) — BREMEKAMP, C. E. B. (Pasoeroean Experimental Station) in *Archief voor Suikerindustrie in Nederlandsch-Indie*, No. 14, pp. 514-519. Sourabaya, April 1914.

The vascular system of sugar cane plants suffering from sereh is stopped up with gummy matter which influences the circulation of water in the plant so that healthy stems absorb 1.18 times more water than affected stems. Using a lithium salt as an indicator, the writer showed that the salt had risen to a height of 70 cm. in 3 ½ hours in a healthy plant, while in a diseased plant it had only reached 30 cm.

STIMULANT, AROMATIC, NARCOTIC AND MEDICINAL CROPS

633 – **Coffee in Tonking.** — BOREL, M. in *Bulletin Economique de l'Indochine*, Year XVII, No. 106, pp. 54-60. Hanoï, January-February 1914.

The coffee bush is little pruned in Tonking owing to the borer (*Xylotrechus quadrupes*), which causes so much damage on plantations that planters allow suckers to grow in order to furnish a substitute for the parent bush when the latter is attacked by the beetle. On the other hand the bushes are kept low by being topped as soon as they are one year old in order to develop the lower branches and expose the young plant less to the action of the wind. Usually the trunk is not allowed to grow above 5 ft. making with the uppermost branches a total height of 6 to 6 ½ ft., which could not be increased without letting some of the fruit get out of reach of the pickers.

Manurial requirements per bush are : 55 lbs. of dung every two years ; ¾ oz. of nitrogen, 1 oz. phosphoric acid and 2 ½ oz. of potash every year ; and every three years a dressing of lime varying in amount with the nature of the soil.

The yield per bush varies from ½ lb. to 2 lbs. of coffee, with an average of about 1 lb. Approximate estimates of expenses and returns on coffee plantations are as follows :

A. *Plantation of* 50 000 *bushes.*

	£
Total cost of establishing plantation spread over 4 years . .	4 310
Expenses during 5th year	1 188
Sales during 5th year :	
44 000 lbs. of coffee	1 804
live stock run on the plantation	225
Total sales . . .	£ 2 029
Total profit.	841
less 15 per cent. to manager.	126
net returns . . .	£ 715

or a return of 16.6 per cent. on a capital of £ 4 310 over and above a 5 per cent. interest on capital allowed for in estimated expenses.

(1) See No. 1541, *B.* May 1911. [*Ed.*]

B. *Plantation of* 160 000 *bushes.*

		£
Total cost of establishing plantation spread over 4 years . .		10 512
5th year:		
expenses . .	estimated to counterbalance	3 267
receipts . .	one another	3 310
6th year:		
expenses		3 375
receipts		6 505
total profits		£ 3 130
less 15 per cent. to manager.		470
	net returns . . .	£ 2 660

or a return of 25.3 per cent. on a capital of £10 512 over and above a 5 per cent. interest on capital allowed for in estimated expenses.

634 – **Mocha Coffee Culture.** — RIES, M. and BARDEY, P. in *The Tea and Coffee Trade Journal*, Vol. XXVI, No. 1, pp. 19-26. New York, January 1914.

Mocha coffee derives its name from the small ruined town on the South Arabian coast of the Red Sea from which it used to be exported. It is an absolutely unique product with a flavour and aroma quite distinct from the Abyssinian variety, though many writers consider them identical.

The tree is cultivated in the province of Yemen, South-western Arabia, on terraced slopes, a southern aspect being preferred. The seeds, after being separated from the pulp, are rolled in ashes and preserved in a dry place. Seedlings are raised in nurseries on a fertile and well manured soil; they are protected from the sun, watered frequently and transplanted once or twice before being finally planted out 2 to 3 yds. apart. Plantations are all in the immediate neighbourhood of wells, as irrigation is absolutely necessary; the soil has to be kept loose and permeable by repeated cultivations. The crop is harvested continously from August to March; the seed is hulled in a small stone mill, spread out to dry and packed in bags made of woven aloe fibre (« sanseviera ») and lined inside with the leaves of palm trees (« doum »), this packing being known in the trade as the Mocha bag and constituting a kind of certificate of origin.

The trees belong to three main types: 1) pyramidal with the biggest branches at the base; 2) umbrella shape with the lower part of the trunk bare; 3) bush shaped.

In the low regions where rain is abundant, the fruit is larger but of inferior quality; in the hot dry uplands, growth is slower and the grain is smaller and rounder, but of the finest quality.

The annual production of Mocha coffee is about 100 000 bags of 160 lbs. each, and the principal importing countries are the United States which takes 30 per cent., France which takes 20 per cent. and Egypt which takes 18 per cent., others being the Red Sea ports (7 per cent.), Germany (5 per cent.), England (5 per cent.), Spain (3 per cent.), and Austria (3 per cent.). About half the amount is exported from Aden, and half from Hodeidah.

635 – **Vanilla in Madagascar.** — FAUCHÈRE, A. in *Journal d'Agriculture Tropicale*, Year XIV, No. 154, pp. 105-109. Paris, April 30, 1914.

Vanilla is successfully cultivated on various kinds of soil in Madagascar, not only on granitic alluvial soils, but also on the sandy soils of the coast and on basaltic or volcanic soils, though the two latter kinds are perhaps the most suitable. From a series of analyses carried out by the writer it would seem that a soil with a high phosphoric acid content is specially good, the best at Nossy-Bé containing a minimum of 0.4 per cent. and that of the most productive plantation containing 0.75 per cent.

The most usual shade and support tree is *Jatropha Cureas*, but *Dracæna tesselata* is also frequently used. Vanilla cuttings should always be at least 5 ft. long; they cost 2*d* to 2 ½*d* each. Decomposed banana stems are frequently used as manure in vanilla plantations.

The production of vanilla in Madagascar has been increasing of recent years. The figures for 1903-1912 are as follows:

	Amount tons	Value £
1903	11.5	8 264
1904	9.1	6 892
1905	30.4	18 619
1906	40.0	19 029
1907	50.0	39 875
1908	56.4	41 748
1909	42.6	47 639
1910	42.2	50 846
1911	51.7	40 986
1912	112.0	142 217

Further increases are anticipated, but over-production will be checked by the growing practice of planting other crops in vanilla districts.

Plant bugs are destructive to vanilla in Madagascar, especially *Memia viccinia* which punctures the pods and young buds, causing them to fall. Preventive measures have not yet been thoroughly investigated, but it would seem that the only means of checking the parasite would be treatment with hydrocyanic acid.

An average yield of vanilla in the green condition would amount to 530 lbs. per acre, while expenses of establishing the plantation are estimated as follows:

	per acre £	s
1st year – clearing ground, planting shade and support trees, planting vanilla cuttings, 3 hoeings	14	7
2nd year – 3 hoeings, cutting shade trees, replacing cuttings	5	17
3rd year – as 2nd	5	17
4th year – as 2nd, pollination (22*s*) and harvest (14*s*)	7	13
	£33	14

636 – **The Cultivation of Poppies for Opium and Seed in Various Countries.** — *Enquiry made by the International Institute of Agriculture.*

The cultivation of poppies for opium in the Far East has been somewhat checked of recent years, but the crop remains an important one in many countries on account of the edible oil produced from its seeds. The replies to the circular letter on the subject sent by the Institute are abstracted below.

AUSTRALIA. — Victoria is the only State in the Commonwealth in which poppies are cultivated on a commercial scale, and even in that State, the area under the crop is very small, consisting of one or two acres during the years 1908-1912 with a total yield of 89 lbs. of opium in the whole period. The present price of opium is 30*s* a lb. and the product is used exclusively for pharmaceutical purposes.

CHINA. — According to the special convention of the Opium Agreement signed in 1911 between the English and Chinese Governments, the cultivation of the opium poppy in China and the importation of opium from India were to be proportionately and progressively reduced, starting from January 1st 1911, so that both local production and imports were to cease entirely by the end of 1913 and opium smoking to be prohibited after 1917.

EGYPT. — Poppies are cultivated in Upper Egypt chiefly for the sake of opium ; oil is also extracted from the seeds and used for cooking.

Three varieties are cultivated, having respectively red, yellow and dark brown seeds, and all belong to the same species. In 1912-1913, 516 feddans (1) were under the crop, which is partly raised as a pure crop and partly in mixed cultures with other crops, such as wheat, barley, onions, fenugreek, *Carthamus oxyacantha*. Seed is sown in October, after the flood, at the rate of 1 kadah (2 ¼ quarts) per feddan and mixed with fine soil to facilitate the operation ; no manure or irrigation water is applied. After a month the plants are singled 6 to 8 in. apart and 12 days later they are earthed up. When the plants are five months old, an incision is made in the capsules and the opium is collected the following day in the form of the solidified exudate, which is then kneaded into cakes and dried in the sun for four days. Each capsule is tapped three times.

A considerable amount of labour is required for the crop, making the cost of cultivation rather high :

	Cost per feddan, piastres (2)
Ploughing	50
Sowing	4
Singling	4
Earthing up	9
Making incisions	45
Collecting opium	120
Kneading »	9
Transport and storage	9
Hand threshing the seed with flails	10
Cleaning the seed	10
	270 (£2 15*s* 7*d*)

(1) 1 feddan = 1.038 acre.
(2) 1 piastre = 2.46*d*.

The total production per feddan amounts to 1½ ardebs (8 bushels) of seed, worth 112 piastres (£ 1 3*s*), 8 rotl (1) of opium, worth 960 piastres (£ 9 17*s*) and 120 rotl of oil. The stalks are sold for fuel and fetch 5*s* per feddan. An ardeb of seed yields about 80 rotl of oil, and the opium contains an average of 8 to 12 per cent. of morphine. Prices are very stable.

The only parasite dangerous to poppies is *Agrotis ypsilon*, which is kept in check by hand-picking the larvae.

No statistics exist on the consumption and exportation of opium, but imports for the years 1909-1912 were as follows :

	Amount lbs.	Value £	*s*	*d*
1909.	11 030	7	10	9
1910.	12 961	11	5	6
1911.	10 815	8	0	2
1912.	4 309	5	7	6

FRANCE. — Poppies are cultivated in various districts. more especially in the departments of Somme and Pas de Calais, but also in those of Ain, Aisne, Aube, Cher, Doubs, Maine-et-Loire, Nièvre, Nord, Seine-et-Marne, Deux Sèvres, Vienne and Yonne. The crop is raised for the sake of the oil obtained from the seeds, which is used as an edible oil in the north and also for the manufacture of paints. The two varieties of *Papaver somniferum* known as Pavot Gris Ordinaire and Pavot Œillette Aveugle are grown. The area under this crop, which was between 12 000 and 15 000 acres in 1900, was reduced to between 6450 and 6650 acres in 1910 and 1911.

Poppies replace beets or flax in the rotation. The land is prepared by autumn and spring cultivations, and seed is sown at the beginning of April at the rate of 2 to 3 lbs. per acre. Farmyard manure is applied, or cake residues, with 4 to 5 cwt. of superphosphate per acre. After-cultivation consists in hoeing and singling to a distance of 8 in. apart. Eighteen to twenty-seven bushels of seed are obtained per acre, yielding 45 to 50 per cent. of oil. Mean annual values for the period 1902-1911 are as follows :

Total area under the crop	acres	10 295
Total production	tons	5 100
Production per acre	lbs.	1 108
Total value of crop	£	77 048
Value of 1 cwt. of seed	*s*	15

French publications dealing with the subject.

MOHAMED EFFENDY CHARKÀNY. — *Thèse sur l'opium, soutenue devant l'Ecole de Pharmacie de Paris.* Paris, H. Plou, 1896.

GASTINEL. — *Monographie des opium de la Haute-Egypte* (*Mémoires de l'Institut Egyptien*, Vol. I). Paris, 1862.

(1) rotl = 0.9905 lb.

H. SALLE et Cie. — *L'opium, son histoire, sa culture, ses applications.* Paris, 1900.
Journal de Pharmacie et de Chimie.

Series	Vol.	Page	
3	13	105	Culture en Arménie.
»	23	99	Récolte en Bithynie.
4	1	415	Culture dans la Haute-Egypte.
»	7	137	» »
»	18	66	Culture en Chine.
»	19	158	Culture dans l'Inde.
5	6	481	Culture dans la Zambézie.
6	21	403	Culture aux Etats Unis.
»	25	542	Culture.

CHALLAMEL has also recently (1913) published a book on opium.

JAPAN. — Poppies are only cultivated on a very small scale for the sake of the flowers and seeds, which are used in perfumery.

BRITISH INDIA. — Poppies are cultivated in the United Provinces of Agra and Oudh, in certain States of Rajputana, and in Central India, but they are no longer grown in Bihar. Opium production both for home consumption and for export is the main object, but the seed production is also considerable, as shown by the following figures :

Exports of poppy seeds.

	Amount cwt.	Value £
1910	814 871	559 890
1911	770 741	545 871
1912	497 862	391 899

The alkaloids morphine and codeïne are manufactured from the opium and are mostly disposed of on the London market.

Owing to the restriction in the export of opium to China the area devoted to poppies in India has decreased from 564 585 acres in 1906-1907 to 182 558 in 1912-1913 and to 156 250 in 1913-1914.

The white variety is commonly cultivated, and grown from October to March after maize or millet. Usually it is grown alone, but occasionally the preceding maize crop is left standing to attract the insects which would otherwise injure the poppies. Heavy black cotton soils are preferrred, and fields are selected in the highly manured circles round the villages, which receive 150 to 200 maunds (1) of cattle dung per acre per annum ; in Fatehpur the land is often manured by herding sheep and goats on it, the dung of which is supposed to be of peculiar value. The plants benefit greatly if they are irrigated with well-water impregnated with nitrates (Khari), and manured with earth impregnated with saltpetre (Nonamati) or well rotted cow dung ; ashes are also extensively used as top dressings. A finely powdered tilth is absolutely essential and the land is ploughed as

(1) maund = 28 lb.

many times as the cultivator has leisure for. Seed is sown from the middle of October to the end of December at the rate of about 3 lbs. per acre, having been previously mixed with earth. The ground is almost always prepared for sowing by a watering and in the drier portions of the United Provinces the plants are irrigated once a fortnight or three weeks between germination and harvest time, while in the Benares division four or five waterings are usually sufficient. The field is kept scrupulously clean, being weeded and thinned at frequent intervals.

The crop is ripe in February or March and the opium is extracted by means of incisions made in the pods in the afternoon, the exuded juice been collected the next morning. Each pod is lanced three or four times at intervals of two to four days. Linseed oil is freely used to remove opium that has hardened on the pod and as a medium in which to store the opium to prevent its drying out.

The process of manufacture is not ordinarily undertaken by the cultivator, but is in the hands of firms by whom the produce is bought and by whom the cultivator is often partly financed. The process is a very simple one : the opium is kneaded into balls and stored in racks covered with the dry leaves and stalks of the poppy plant. As it dries, the balls are apt to lose their shape and are periodically examined and reshaped, considerable importance being attached to the balls being spherical in shape and free from cracks, especially by the Chinese connoisseur.

Cultivation expenses amount to roughly 40 rupees (£ 3 6*s* 8*d*) per acre.

The specific diseases to which the poppy is subject in India are : *a*) root canker ; *b*) sun burning ; *c*) sclerosis, the symptoms of which are a gradual drying and hardening of all the plant tissues ; *d*) *patechia*, in which the cuticle of the leaves becomes more or less densely covered with specks or spots somewhat resembling those caused by the bite of insects ; and *e*) gangrene, which mostly affects the soft, herbaceous parts of the plant. Injuries are also caused by broomrape, various fungi, insects and birds.

The output of opium during 1912-1913 was approximately 19 854 cwt., excluding that grown in the Native States for which no reliable details can be given. The average content of morphia in opium ranges from 6 to 10.26 per cent. The whole of the opium produced is sold to Government by the cultivators at a fixed price and is then manufactured for export and for internal consumption. The quantity intended for export is put up to public auction in Calcutta every month in chests containing 140 lbs. each.

Imports and exports of opium during the period 1908-1912 are given below ; imports consist mostly of Persian and Turkish opium required for pharmaceutical purposes ; exports go to China and other countries.

	Imports lbs.	Exports cwt.
1908.	213	68 210
1909.	260	81 329
1910.	431	68 392
1911.	422	62 575
1912.	554	42 787

During 1913 the quantity to be exported was fixed at 32 125 cwt., the systematic reduction being due to the policy of restricting exports to China. The estimated annual consumption of opium in British India is 10 982 cwt.

For further reference see :

Watt's Dictionary of the Economic Products of India, Vol. VI, Part I. London, W. H. Allen and Co.

NETHERLANDS. — Poppies are cultivated in districts possessing a heavy soil, more especially in the provinces of Groningen, North Holland, South Holland and Zealand. A variety of *Papaver somniferum* L. with blue flowers, indehiscent capsules and grey or grey-blue seeds is in common use, and the plant is cultivated for the sake of its seeds from which oil is extracted. The average area under this crop during the period 1901-1911 was 808 acres, but increased to 1623 acres in 1912 owing to the rise in price of the seeds.

Poppies follow red clover, oats or barley in the rotation: cultivation consists in ploughing deeply and applying dung or superphosphate according as the preceding crop was a cereal or a leguminous crop. Seed is sown in April or May in drills 24 to 26 in. apart and the plants are singled to a distance of 3 to 5 in. apart in the rows. The crop is kept hoed and ripens in August, being harvested in a very dry condition so that the capsules may be threshed immediately ; if threshing has to be delayed the plants are tied in bundles and placed in small heaps.

The average production per acre amounts to 18 to 22 bushels of seed, yielding 50 to 60 per cent. of oil, and 12 to 16 cwt. of straw. Poppy cake makes a useful cattle food, but the poppy straw is of very little value.

Prices for poppy seed ranged very high in 1910, causing an increase in the area under the crop in 1912. As a result, before the harvest the seed fetched £1 9*s* 4*d* a cwt., but after it fell to about £1.

Poppies are a hardy crop and have few enemies in the Netherlands.

There exists no special publication on the cultivation of poppies in the Netherlands, but a chapter is devoted to the subject in *Byzondere Plantenteelt*, J. Z. TEN RODENGATE MARISSEN. Groningen, J. B. Wolters.

PERSIA. — Poppies are cultivated in all the provinces except Kazvine, Zindjan, Guilan, Mazenderan, Astrabad and parts of Azerbaydjan. The white flowered variety is commonest and the red and purple flowered varieties are also grown, the production of opium being the chief object. The harvest is very early, especially in the south, so that the crop is usually followed by melons, sesame, lentils, beets, millet, etc., and then the land is again put to poppies, or the poppy crop may be followed by two years' fallow. Cultivations consist of a single ploughing (or spading in the South) and dung or nightsoil is used as manure. Seed is broadcasted at the rate of 1.4 to 1.8 quarts per acre. The crop is hoed for the first time as soon as the seedlings have four leaves and they are then singled to a distance of 6 to 8 in. apart ; a second singling takes place after 20 to 30 days, further thinning out the plants to 10 to 12 in. apart. Irrigation is applied as required with a maximum of three waterings.

Opium collecting from incisions begins when the two lowest leaves have turned yellow, when the three upper leaves begin to lose their colour and the operculum of the capsule blackens. Incisions are made at midday and the exudate is collected at sunrise the next morning. A second incision is made a few days later, but the yield in this case is much smaller.

Expenses for raising the crop amount to about £5 per acre, average returns being 200 lbs. of seed and 32 lbs. of opium per acre, fetching 13*s* 4*d* per cwt. and 14*s* 4*d* to £1 5*s* 2*d* per lb. respectively. Imports and exports of opium are as follows :

		Amount lbs.	Value £
Imports . . .	1908	997	354
	1909	543	174
	1910	610	232
	1911	7 915	7 636
	1912	2 421	2 834
Exports . . .	1908	580 737	250 112
	1909	663 345	306 034
	1910	494 434	229 042
	1911	528 959	391 317
	1912	719 162	607 238

The home consumption is considerable, though its actual amount is unknown.

SERVIA. — Poppies are cultivated on a large scale only in those parts annexed during the late war, and no data on the subject are at present available.

637 – ***Cymbopogon coloratus* Oil from Fiji.** — *Bulletin of the Imperial Institute*, Vol. XII, No. 1, pp. 48-51. London, January-March 1914.

Recent investigations have been carried out at the Imperial Institute on the composition of the essential oil of *Cymbopogon coloratus*. The principal constituents are citral (40 per cent.) and geraniol (23 per cent. in the free state and 10 per cent. in the form of geranyl acetate); the oil is therefore intermediate in composition between citronella and lemon-grass oils and was assigned a value intermediate between those of the two above products by commercial experts.

FRUIT GROWING

638 – **Winter Spraying of Fruit Trees with Nitrate of Soda.** — BALLARD, W. S. and VOLCK, W. H. in *Journal of Agricultural Research*, Vol. I, No. 5, pp. 437-444, + 2 plates. Washington, D. C., February 1914.

These experiments on the effect of winter spraying with various solutions on the time of blooming and yield of fruit were begun in February 1912 and continued during 1913. The orchards used consisted of the Yellow Bellflower variety of apples, which bloom abundantly but only set a poor crop of fruit.

Seven 12-year-old trees were sprayed on February 2, 1912, with a solution of : nitrate of soda 50 lbs., caustic potash 7 lbs. and water 50 gallons, at the rate of 7 gallons per tree. Adjoining this row was a check row

of seven trees which received no winter spraying and a selected vigorous tree which received 50 lbs. of nitrate of soda ploughed in and washed down by the rains. In April it was found that the nitrate spraying had advanced the blossoming period about two weeks ahead of the normal period. The foliage buds were not so much affected, their condition remaining similar to that of the check row. Later in the spring the effect on the foliage growth became more pronounced and the sprayed trees assumed a more vigorous green appearance than the check trees. The single tree that received 50 lbs. of nitrate of soda applied to the soil showed no greater vigour than the check trees. During the summer both rows received sprayings for the control of apple powdery mildew and codling moth, and the crop loss from these and other insect pests did not not exceed 1 per cent. on either plot.

In the autumn, the check row of trees yielded 8 loose boxes of fruit, while the nitrate-sprayed row produced a little over 40 boxes. The single tree which received 50 lbs. of nitrate as fertiliser showed no increased production. In the spring of 1913 this row of nitrate-sprayed trees showed large plump fruit buds and blossomed several days ahead of the control row, showing that the effect of the winter spraying continued to some extent in the second year.

Similar experiments were carried out in 1913, using different solutions ; it was found that:

1. A solution of nitrate of soda (1 lb. per gallon) stimulates the trees to blossom earlier, and the effect is increased by the addition of either caustic soda or caustic potash.

2. The effect is proportional to the strength of the solution within certain limits. The best results were obtained with a solution of the following strength:

Nitrate of soda	200 lbs.
Caustic soda	20 lbs.
Water	200 gallons

3. Oxalic acid at the rate of 50 lbs. per 125 gallons of solution can replace the caustic soda with equally good results.

4. Nitrate of lime (130 lbs. per 100 gallons) and calcium cyanamide (92 lbs. in 100 gallons) also caused the trees to bloom earlier.

5. Sulphate of ammonia is considerably less effective than nitrate of soda.

6. Sodium chloride produced a distinct effect, sulphate of potash a slight effect and double superphosphate none at all.

7. The results with stone fruits were not so striking as those with apples and pears, but it is possible that stronger solutions together with earlier and repeated spraying may bring about better results.

Rain immediately following the application will wash much of the material off the trees, and it appears that at least a week of clear weather should follow the spraying, in order to ensure good results. The greater

danger of injury from frost that might result from forcing trees into bloom earlier than normally would have to be taken into consideration in making practical use of nitrate spraying in winter.

639 – **The Effect of Dust from Cement Mills on the Setting of Fruits.** — ANDERSON, P. T. in *The Plant World*, Vol. 17, No. 3, pp. 57-68. Tucson, Arizona, March 1914.

The decrease in the productivity of fruit trees in the vicinity of cement mills is attributed to the solution of the dust in the stigmatic secretions, which prevents the germination of the pollen. The dust contains a large amount of alkaline soluble lime, and artificial tests show that pollen will not germinate even in a very weak solution of the dust.

640 – **Shallow Cultivations in Vineyards.** — COUDERC, in *Comptes-Rendus de l'Assemblée Générale de* 1914 *de la Société des Agriculteurs de France*, No. 3, pp. 525-526. Paris, May 19, 1914.

In order to avoid chlorosis in shallow soils overlying chalky subsoils, very shallow cultivations, less than 1 in. deep, were adopted and gave good results. Not only were the vines less affected with chlorosis, but they also suffered less from drought. A light spring-tine cultivator was used for the purpose, and cultivations had to be carried out before the weeds got any hold on the land in order to keep it clean. Such shallow tillage cannot be practised indefinitely, as after a certain number of years the soil must again be stirred to a greater depth and well manured in order to stimulate the growth and development of the roots, which would otherwise succumb to the attacks of phylloxera.

641 – **Influence of American Vine Stocks on the Quality of the Wine Produced in Champagne, France.** — MANCEAU, F. in *La Vie Agricole et Rurale*, Year III, No. 22, pp. 621-624. Paris, May 2, 1914.

The wine produced from grafted vines has been compared with that from ungrafted vines each year since 1897. A number of research stations exist for the purpose in Champagne and growers send in numerous samples to be examined, so that a large amount of data is accumulating and it will shortly be possible to publish a list of American vine stocks classified according to their influence on the resulting wine.

The quality of samples is determined partly by tasting and partly by chemical analysis. Testing is carried out at various times of year, in the January or February following the vintage, and again in subsequent years during the second fermentation in bottles for champagnisation; thus reliable results are obtained by following out the process of maturation in the wines. The investigations have shown that only a few stocks exercise an unfavourable influence on the wine; the majority when grafted with Meunier, Pinot noir and Chardonnay blanc, yield wines up to the general standard of the district; specially good stocks recommended by the writer are the following :

Chasselas × Berlandieri 41 B for calcareous soils.
Berlandieri × Riparia 420 A, 34 E. M. and 157-11.
Riparia × Rupestris 3309 and 101-14.

The stocks influence the ripening period: for instance Pinot noir on Riparia Gloire of Montpellier ripens 8 to 10 days sooner than on its own roots; on Chasselas Berlandieri 41 B it is 5 to 6 days earlier; Mourvèdre × Rupestris 1202 on the other hand retards its ripening 8 to 10 days, while Riparia × Rupestris 5306 and 3309 also have a slight retarding influence.

642 – **The Papaya in Hawaii** (1). — HIGGINS, J. E. and HOLT, V. S. in *Hawaii Agricultural Experiment Station, Bulletin*, No. 32, pp. 44. Washington, March 26, 1914.

The papaya (*Carica papaya*) flourishes in all drained and aerated soils in Hawaii. Though irrigation will increase the crop, an abundant water supply is not essential and papaya will give good results on a soil just too dry for oranges. Suckers should be removed at first, but after the plant has fruited two or three times, the main stem should be cut down and replaced by one of the suckers left for the purpose. The whole plantation should be renewed after about four years' bearing.

The fruit will travel well if certain precautions be taken, *i.e.* the fruits, preferably those belonging to the long-fruited varieties, should be picked at the first sign of ripeness, wrapped in paper and packed in straw board

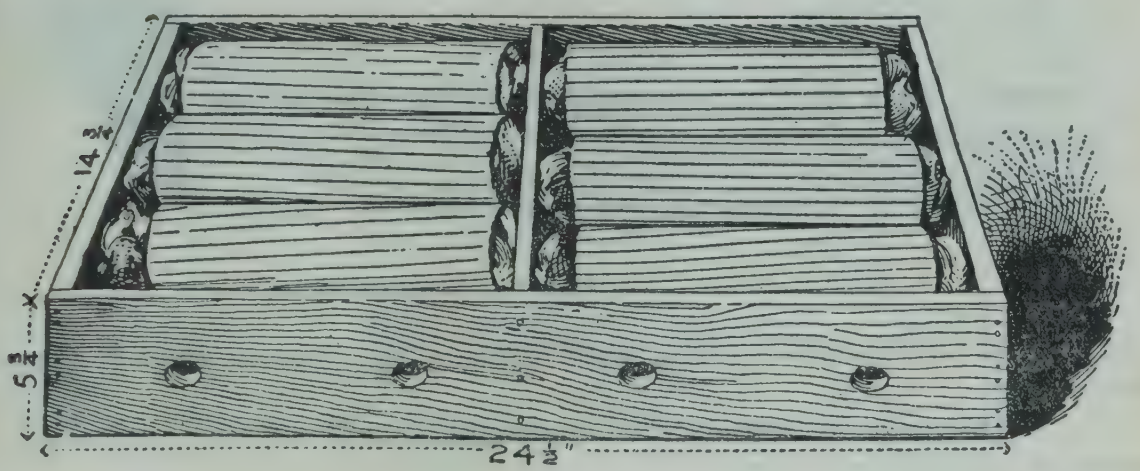


Fig. 1. — Crate for transport of papayas (open).

in well ventilated crates (the size of the latter is indicated in the accompanying figs. in inches).

Seed kept for propagation is washed and dried and preserved in glass bottles; it is sown in a well drained soil and germination takes place in from two to six weeks according to the temperature; when one month old the seedlings are transfered to a nursery, and at two months old are planted out about 10 feet apart. Experiments on vegetative propagation carried out at the Experiment Station have given promising results, making it probable that the fruiting season will eventually be made several months earlier. In breeding papayas, the following points should be borne in mind:

(1) See No. 813 *B.* July 1913. (*Ed.*).

1. Trees bearing their fruit high (more than 6 ft. from the soil level) are preferable to those bearing their fruits close to the soil.

2. Numerous lateral branches requiring frequent pruning are a disadvantage.

3. Hermaphrodite or elongata varieties are better than round dioecious varieties, as males represent 75 to 85 per cent. of the latter and cannot be distinguished before flowering.

4. The most desirable size of the fruit depends on the use to which it is to be put. Table fruit should not be too large, while fruits for the production of papain should, other things being equal, be as large as possible ;

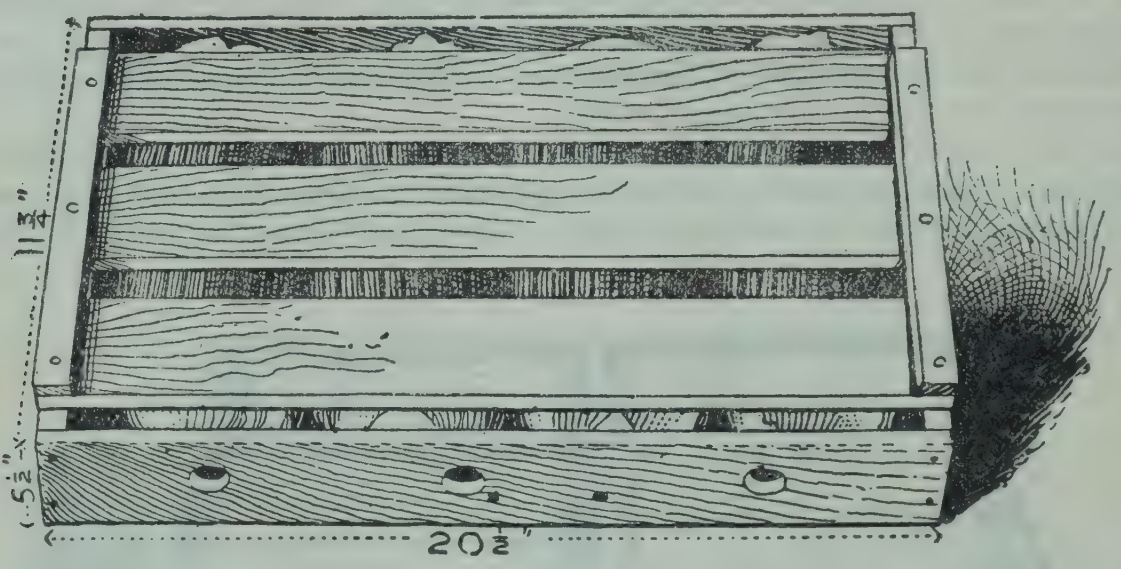


Fig. 2. — Crate for transport of papayas (closed).

and for this latter purpose too, fruit with a high papain content should be selected.

5. The long and round varieties should be kept separate and bred as constant and distinct types.

6. At present there is a tendency to unequal ripening of the opposite ends of the fruit which should be corrected. The ripe fruit should be of a fine yellow gold colour ; the flesh should be firm and of a yellow, red or pink colour, easily detached from the seeds and placenta and possessing a good flavour.

The papaya tree is subject to attacks from *Tetranychus* sp. on the lower surface of the leaves and on the fruits, and from the larva of the fly *Cryptoblabes aliena*, neither of which are serious enemies.

The harvest and preparation of papain are described in this bulletin.

643 – **Propagation of the Seedless Breadfruit.** — WESTER, P. J. in *The Philippine Agricultural Review*, Vol. VII, No. 3, pp. 97-99. Manila, March 1914.

The seedless breadfruit is one of the best and most nutritious fruits in the Philippines, but it is also one of the rarest owing chiefly to the difficulty of propagating it. The ability of the roots to sprout under certain conditions led to a series of experiments being carried out in 1913 at the

Lamas Experiment Station with the object of finding a simple and practical method of propagation. The following method gave good results: Root cuttings 20 to 25 cm. (8 to 10 in.) long and 1.5 to 6 cm. (½ to 2 ½ in.) thick are struck in a bed consisting of a layer of clean sand 18 cm. (7 ½ in.) thick situated in a sheltered and well drained position. The cuttings are inclined at an angle of 45° and buried three-quarters of their length, being set 20 to 30 cm. (8 to 12 in.) apart in rows 30 to 50 cm. (12 to 20 in.) apart . If planted in the rainy season, the cuttings require no further care; if not they must be watered. When 20 to 25 cm. (8 to 10 in.) high the cuttings are transplanted to a rich shaded soil, and when the plants are 60 cm. (24 in.) high they are ready for transplantation to the orchard. The roots should be disturbed as little as possible during the operation and a large ball of earth be moved with the plant. In replanting it is important not so set the plant deeper in the soil than it was in the nursery and a plentiful use of water should be made both before and after the operation.

LIVE STOCK AND BREEDING.

644 – **Results of Preventive Inoculation against Foot-and-Mouth Disease in Hungary, 1913.** — MEZAY, BÉLA in *Allatorvosi Lapok*, 1914, p. 238. HYGIENE

From observations made by the writer during the last campaign against foot - and - mouth disease in Hungary, it appears that, after undergoing preventive inoculation against this disease (aphtisation), a large number of animals became seriously ill. In many cases recourse had to be had to operations, while in others further complications caused by other diseases were set up, and some cases resulted in death.

In one district, the disease reappeared two or three months after the inoculation in a form more dangerous than the first.

645 – **Utilization of Potato and Jerusalem Artichoke Haulms.** — VÖLTZ, WILHELM; BAUDREXEL, AUGUST; and DEUTSCHLAND, ARNOLD in *Landwirtschaftliche Jahrbücher*, Vol. 46, Part 1, pp. 105-160. Berlin, March 11, 1914. FEEDS AND FEEDING

The writers carried out at the Berlin Agricultural College exhaustive experiments on the utilization of dried and ensilaged potato haulms and dried leaves and stalks of Jerusalem artichokes. The animals used for the experiments were three sheep and four milch-cows ; they were fed good meadow hay besides the experimental fodder. The haulm was from Silesia potatoes, and was dried in a hot-air apparatus ; some was fresh when cut, while some had been frosted. For the utilizationtr ials, two sheep were fed each ¾ lb. of hay with 1 lb. of haulm, the fresh haulm period preceding the frosted haulm one.

From these trials, as well as from a previous one (1) made with haulm from Wohltmann potatoes dried on the field, it appears that the percentage digestibility of dried potato haulm is about as follows:

(1) Cf. W. VÖLTZ and A. BAUDREXEL: Ueber die Verwertung des Kartoffelkrautes und der Kartoffelbeeren durch Wiederkäuer. *Landw. Jahrbücher*, Vol. 43, pp. 177-210. Berlin, 1912.

Organic matter	Crude protein	Crude fat	Crude fibre	N-free extract	Calories
64	57	53	66	68	63

There was very little difference between the three types, and none of them upset the health of the animals.

The amount of digestible nutritive matter contained in dried potato haulm appears from hese experiments to be about the same as that of good meadow hay; this is confirmed by a later experiment on four milch-cows, carried out wi h the object of ascertaining the effect of potato haulm on the quantity of milk and milk-fat and the total dry matter in the milk.

Ensilaged potato haulm was also prepared from the green haulm kept two months in a silo under strong pressure; after this, part was dried and the other part preserved in tin boxes. The loss of crude nutritive matter in the silo was 33 per cent. on the organic matter and 25 per cent. on the crude protein, while the digestible nutritive matter lost 35 per cent. on the organic matter and 13 per cent on the crude protein. The first utilization trial was made with the moist ensilage; two sheep were fed daily 4.4 lbs. ensilage with 0.77 lb. hay and 3.72 lbs. ensilage with 0.65 lb. hay respectively. Then followed an experiment with dried ensilage, during which one sheep was fed daily 0.78 lb. ensilage and 0.62 lb. hay.

Of the nutritive matter contained in the ensilaged potato haulm the following percentages were digested:

	Organic matter	Crude protein	Crude fat	Crude fibre	N-free extract	Calories
Fresh ensilage	62	62	66	60	63	58
Dried ensilage	65	56	77	65	67	66

The leaves and stalks of Jerusalem artichokes were dried by hot air and 1 lb. of them fed daily with $^3/_4$ lb. of hay to two sheep. As percentages of digestibility the following figures were found:

Organic matter	Crude protein	Crude fat	Crude fibre	N-free extract	Calories
65	55	70	54	72	66

According to its content of crude nutritive matter and digestibility, the Jerusalem artichoke haulm is about equal in value to good meadow hay. When fed alone, however, it causes strong fermentation in the alimentary canal, so that not more than half the bulky food should be replaced by it.

646 – **Feeding Experiments with Rice Gluten Food.** — HANSEN, REISCH, E. and SCHWEIGER, M. in *Deutsche Landwirtschaftlche Tierzucht*, Year 18, No. 21, pp. 245-248. Hanover, May 22, 1914.

Under the name of " Reiskleberfutter ", a food for milch cows is sold in Germany; it consists of a mixture of rice gluten and rice meal. The first is a by-product of the rice starch factories and is rich in protein, while the latter is a residue of rice milling. The writers have conducted a feeding experiment with the mixture which has the following composition :

Dry matter	93.30	per cent.
Crude protein	36.94	» »
Pure protein	31.25	» »
Fat	11.86	» »
N-free extract	36.87	» »
Crude fibre	1.32	» »
Ash	5.31	» »

The amount of nutritive matter contained in the food is so high that it places the mixture on a level with oil cakes countaining an average amount of protein. Its starch value is, according to the authors, about 71.77 per cent. and its protein content 22 per cent.

The food was fed with meadow hay, dry beet slices and brewer's grains mixed with molasses as basal ration, and compared with earthnut cake and wheat bran. The animals experimented upon were 18 Lowland cows in full milking. The quantity of rice gluten food was 6.6 lbs. during one period and 11 lbs. during the next. During the 75 days that the experiment lasted, record was kept of the daily milk yield, of its quality and of the changes in the live-weight of the animals.

The results of the experiment are that the rice gluten food under examination has the same value as a mixture of earthnut cake, dry beet slices and wheat bran ; consequently the writer recommends it for the feeding of milch cattle when it can be bought at a suitable price.

HORSES, ASSES AND MULES

647 – **Colt-breeding in Pennsylvania.** — COCHEL, W. A. and SEVERSON, B. O. *Pennsylvania State College, Agricultural Experiment Station, Bulletin* No. 122, 14 pp. Centre County, Pa., July 1913.

The writers carried out, in the State of Pennsylvania, where all the farmers buy their draught horses, a breeding experiment with 10 weaned Belgian and Percheron colts, with a view to ascertaining whether it is profitable for the farmer to breed his own draught horses.

The colts were divided into two groups of 4 and 6, and were fed, during the 532 days covered by the experiment, in the manner shown in Table I.

TABLE I. — *Daily Ration of each Colt.*

1. *Winter Period* (168 days).

1st Half.	Group I.	5 lbs. mixed grain (1); 8.2 lbs. maize ensilage; 7.4 lbs. hay.
	Group II.	5 lbs. mixed grain (1); 10.6 lbs. hay.
2nd. Half	Group I.	7.5 lbs. mixed grain; 13.1 lbs. hay.
	Group II.	Same as Group I.

2. *Summer Period* (106 days).

Both Groups: For the first 28 days: 5.5 lbs. mixed grain; 10.6 lbs. hay.
Afterwards: pasture, with mixed grain as supplementary food.

3. *Winter Period* (168 days).

1st Half: Both Groups: 8.4 lbs. of a different mixture of grain (2); 16.6 lbs. hay.
2nd Half: Both Groups: 10 lbs. mixture (2); 17.5 lbs. hay.

Note. Mixture (1) was composed of: 5 parts maize.
3 parts oats.
2 parts wheat bran.
1 part linseed meal.

Mixture (2) was composed of: 6 parts maize.
2 parts oats.
1 part wheat bran.
1 part linseed meal.

The animals, which were then two years old, were broken to work after the third period of the experiment.

The experiment was carried out without mishap and gave the results shown in Table II.

TABLE II. — *Results of the Experiment.*

Average weight per colt at the beginning	589.87	lbs.
» » » » after the 1st. Period	834.14	lbs.
» » » » » » 2nd. »	1 097.71	lbs.
» » » » » » 3rd. »	1 318.96	lbs.
Average increase in live weight per colt in the 1st. Period	244.27	lbs.
» » » » » » » » » 2nd. »	263.57	lbs.
» » » » » » » » » 3rd. »	219.25	lbs.
Average daily increase in live weight per colt in the 1st. Period	1.45	lbs.
» » » » » » » » » » 2nd. »	1.34	lbs.
» » » » » » » » » » 3rd. »	1.30	lbs.
Total increase in live weight per colt	727.09	lbs.
Average daily increase in live weight per colt	1.36	lbs.
Total cost of food and labour	$ 980.893	
Total cost of the ten colts by the end of the experiment	$ 1 893.390	
Value of the ten colts	$ 2.350	
Profit on the ten colts	$ 456.610	
Profit per colt	$ 45.661	

CATTLE

648 – **Crossing Bison and Cattle.** — 1. BOYD, MOSSOM M. (Bobcaygeon, Ont., Canada) in *The Journal of Heredity*, Vol. V, No. 5, pp. 191-197. — 2. GOODNIGHT, CHARLES (Goodnight, Texas) *Ibid.*, pp. 197-199. Washington, May 1914.

1. — Mr. Mossom M. Boyd publishes the first results obtained from his four years' experiments in the crossing of bison with domestic cattle.

He obtained about 30 hybrids. As to colour, the offspring of Hereford dams had white faces, but apart from these, the animals were practically whole-coloured, and were either brindled or a rich brown-black. The brindled varied between a tawny red and brown. The hybrids were, as a rule, larger and better proportioned than the bison; they stood more upright, had a less shaggy coat, and were altogether of better appearance.

The $^3/_4$ bisons, the product of a bison bull and hybrid females, did not differ one from another more widely than do different specimens of hornless Aberdeen-Angus. Their characteristics were midway between those of their parents. The $^1/_4$ bisons (Aberdeen-Angus or Hereford sire, hybrid dam) all exhibited the same build, but varied in colour. They resembled one parent as much as the other. The same is true in the case of the $^1/_8$ bison, obtained by a second cross with a pure domestic bovine animal. To the ordinary observer, the $^3/_4$ bison is easily confused with the bison, while the fine texture of the coat will alone serve to distinguish the $^1/_4$ bison from pure-bred domestic cattle. Taken altogether, the type of each class was homogeneous, and the proportion of bison blood regulated the likeness to that animal. As was expected, the proportion of bison blood did not regulate the appearance of the cattaloes (offspring of two crossbred animals). A number of these animals exhibited a greater similarity to the bison than did the hybrids.

On the whole, the results obtained are encouraging. Two especially interesting points immediately emerge, namely:

1. Crossing with bison is capable of improving the coat of the animals. Cattaloes with even less than $^1/_{10}$ bison blood may, with proper selection, have as good a coat as $^1/_2$ or $^3/_4$ bisons.

2. There is hope of being able to effect a great improvement in the capacity for beef-production. The bison's hump does not, as most people imagine, consist of a lump of fat, but of masses of muscle attached to neural spines double the length of those of domestic cattle. If it is borne in mind that the beef from the backs of cattle is the most valuable, it will be easily understood that the development of this characteristic is of first-rate importance. The writer obtained hybrids with humps 9 inches thick.

It is noteworthy that the experiments of the first class are not unattended with some danger. In this case, the principal effect of the first crosses was, in every cow without exception, an abnormal secretion of the amniotic fluid, which proved fatal in a large proportion of cases. Fortunately, considering that nothing of this kind had been in the least expected, the experiment had been made on a very large scale.

It should be observed that the writer was unable to raise a single fertile male hybrid. Of six born, only two survived the first 24 hours, and of these one was killed at an early age, without having been tested, and the other was barren. This agrees with the experiments made by Col. Ch. Goodnight, who states that he was unable to raise hybrid bulls. Ten male $^1/_4$ bisons were obtained, of which four were tried; only one proved fertile. Of five $^3/_4$ bisons only one was a bull, and he died as the result of an accident. The only $^1/_8$ bison tried proved fertile. In 1905 a $^5/_8$ bison was successfully reared, the offspring of a cross between a bison and a $^1/_4$ bison cow. This cross was interesting from the fact that difficulties of the same kind as those mentioned above in connection with the first cross were met with. This bull sired one calf in 1911 and four in 1912.

He is of a more elegant build than the true bison, and has a very well-developed back.

The results given by the crossbred cows are as follows: of 24 hybrids, 15 were barren, and only three were regular breeders. Up to 18 years of age they had respectively 9, 10 and 12 calves. Of the twelve ¼ bison cows only one was barren. Of four ³/₄ bison cows only one proved barren, but it must be admitted that the bull was not a good breeder. Of five ⅛ bison cows, one was spayed at 5 ½ years, without having had a calf up to that time. The other four were fertile.

The writer has not yet been able to obtain any results from the cattaloes, the experiments with which are still going on at the present time.

2. — Col. Goodnight has carried out crossing experiments in Texas between bison and domestic cattle. By putting domestic cows to a bison bull, he has only been able to rear successfully one bull-calf. The ³/₄ bison bulls proved barren, though the cows were perfectly good breeders.

Cattaloes shew a certain number of advantages over domestic cattle. They have a much higher disease-resisting power, especially as regards "Texas Black Leg" and Texas fever. Secondly, their weight is higher, as well as their beef yield (fully 70 per cent.). The beef is of good quality and never becomes leathery as it does in the bullock. The great development of the dorsal region enables them to produce about 150 lbs. more than any domestic animal. They are not subject to cattle panic and do not flee before storms, but face them as bison do. They can stand privation of water much longer than other animals; they are docile and never fight, and can do well under conditions which would be fatal to other animals.

649 – **Observations on the Origin and Distribution of Breeds of Cattle in French West Africa.** — Jacob de Cordemoy, H. in *L'Agriculture Pratique des Pays Chauds* Year 14, No. 130, pp. 24-36. Paris, January 1914.

The cattle of French West Africa may be traced to two definite types: 1) the zebu, or humped ox; 2) the humpless (taurine) type.

These two types have different areas of distribution, but at the borders of the two areas occur numerous races of a mixed or abnormal character, making the distinction more difficult. What is the primary origin of these types? The zebu is certainly an imported type, of Hindu origin, and its line of advance can easily be traced from the East to the West coast of Africa. The origin of the taurine type is a more disputable matter. Many writers admit the Asiatic origin of the taurine stock in Guinea, but Pécaud, who has long made a study of the cattle of Dahomey, thinks that the taurine type is indigenous to Central and West Africa.

The writer does not share this opinion, for two reasons: 1) many Central and West African tribes were cannibals, a practice not observed where meat is obtainable, as is the case when cattle are raised; 2) it is difficult to reconcile the existence of indigenous breeds of cattle with the fact that no aboriginal race practises stock raising; the only tribes which practise it are the Peuhlish peoples and the descendants of Peuhlish mixed marriages, and the Peuhls are foreign immigrants.

The zebu type may always be recognized by the hump, more or less highly developed, above the withers.

The other type is the Asiatic taurine type, which may be recognized by its height and more especially by the horns, which are strongly developed and lyre-shaped, a characteristic which persists in all breeds derived from this stock. A further confirmation of the Asiatic origin lies in the fact that these two types of cattle are found in all the countries right across the continent.

Dr. Decorse has described a third type, which he calls the Lake Tchad breed, but from the description he gives of it it appears to be merely an Asiatic breed. The writers opinion it shared by the Belgian verterinary surgeon Willaert, who only recognizes the zebu and taurine types.

The zebus were introduced by the Peuhlish invasion; they advanced westward along the 14th parallel, and from there some must have gone up and some down the Niger, but they followed rather a north-westerly route, on account of the trypanosomiasis in the south. Nowadays, the distribution of the zebu is limited to the south by the 13th parallel, and to the north by Upper Guinea. The two chief centres of the breed are, on the one hand, Senegal, and on the other, the countries round the mouth of the Niger.

The taurine type, also introduced by the Peuhls, seems to have been given up by them at a fairly early period to the natives of Upper Dahomey. It now forms the only bovine population in Dahomey and Guinea. There are three distinct breeds or varieties :

1. The Borgu breed, in Upper Dahomey.

2. The small Somba breed, found in the neighbourhood of Jugu Kwande and the Atacora Range.

3. The Wemé or Lagoon breed, in Lower Dahomey ; this breed is of small stature and appears to be degenerating in consequence of unfavourable conditions of soil and climate.

Variations due to climate are very noticeable in Guinea. The characteristic breed of Guinea is the N' Dama, which has produced two varieties, one small (43 in. high) and another taller (55 in.), which Ghebbard and the writer believe to be two modifications, produced by the climate, of one and the same breed.

650 – **Connection between Growth of Bone, Horn Development and Performance in Cattle.** — MÜLLER, MAX and NARABE, K. in *Landwirtschaftliche Jahrbücher*, Vol. 46, Part 1, pp. 1-40. Berlin, March 11, 1914.

After a short summary of Laurer's studies on the connection between growth of bone and horn development in Kehlheim (1), Simmental, and Lowland cows, the writers discuss the results of similar work on 59 Dutch, 59 Ayrshire and 18 Simmental cows. These investigations were carried out in Japan on pedigree animals, partly imported and partly bred at Hokkaido.

As in Laurer's investigations, the circumference of the cannon bone,

(1) A local brachycephalous draught breed, chiefly bred in the Upper Bavarian Palatinate.

and the length and circumference of the horns were taken as test measurements. Besides these, ten other measurements were taken with the object of throwing light on other points. After being measured, the animals were divided into groups and studied as to the connection between horn development and size of bones, between horn development and age, and between size of bones and age. The measurements of the Hokkaido-bred cows were compared with those of the imported ones. Besides the above, the relation between bone and horn development on the one hand and milk yield on the other was also studied in Ayrshire cows and at the same time the milk yields and live weights were compared with the horn and bone measurements.

The investigations led to the following conclusions :

1. In the breeds examined, increase in the size of the bones is correlated with decrease in the thickness and length of the horns, as Laurer had already found. This correlation seems to be more marked in Ayrshires than in Simmentals or Dutch cows.

2. The imported and Hokkaido-bred Ayrshire and Dutch cows did not show any appreciable difference in the circumference of the cannon-bone. The absolute circumference of the horns seems to diminish from generation to generation in Ayrshires and Dutch cows bred in Japan. The absolute horn length of the Ayrshire cows born in Japan is greater than in the original Ayrshires, while in the Dutch cows the opposite takes place. The different growth of the horns in the original breeds and in the animals raised in Japan is to be attributed only to the difference of environment.

3. The small-boned Ayrshire cows are in general, notwithstanding their relatively smaller live-weight, better milkers than the large-boned ones weighing about 110 lbs. more. Also the fine-horned Ayrshires under experiment proved better milkers than the thick-horned ones, while length of horn was not correlated with any difference in this respect.

It appears that well developed bone and slightly developed horns in young animals point to a continuation of growth of body, while moderately developed bones together with highly developed horns are signs that body growth will stop early.

651 – **Raising and Fattening Beef Calves in Alabama.** — GRAY, D. T. and WARD, W. F. — *Bulletin of the U. S. Department of Agriculture*, No. 73, 11 pp. Washington, March 30, 1914.

Experiments were carried out to determine the cost of raising calves to the age of 9 ½ months or the profits to be obtained, if any, by carrying them on and fattening them out at 12 months. Sixty-four calves from an Aberdeen Angus herd were selected for the purpose. The calves were born in the spring, ran with their mothers on the pastures till late autumn, were then weaned and prepared for fattening from December 21 to January 17, receiving broom-sedge hay (consisting chiefly of *Andropogon scoparius*), maize silage and cottonseed meal. On January 17, 49 of the calves were put on to fattening rations and kept on this diet until April 1st.

The average weight at 9 ½ months was 460 lbs. and the average cost of raising the calves to that age was $ 14.36. During the fattening period

the average daily increase was 1.37 lbs. on a ration of 4.4 lbs. of cottonseed meal, 23.9 lbs. of maize silage and 2.76 lbs. of broom-sedge hay, so that 100 lbs. of live weight increase required 323 lbs. of cottonseed meal, 1 741 lbs. of maize silage and 201 lbs. of hay, costing $ 7.3. The fat calves were sold at $ 5.87½ per 100 lbs., while the cost of raising and fattening them only amounted to $ 3.61 per 100 lbs. A profit of $ 436.19 was obtained on the whole herd, or an average of $ 6.81 per calf.

652 – **Cattle-Breeding and Dealing in Senegal.** — ADAM, J. in *L'Agriculture Pratique des Pays Chauds*, Year 14, Nos. 131, 132 and 133, pp. 65-80, 149-157 and 193-210. Paris, February, March and April 1914.

The physical conditions of the colony of Senegal make it favourable for cattle-rearing. The nearness to European ports points to beef production as the most suitable branch of the industry and from this standpoint Senegalese cattle may be divided into three groups.

1. The pure-bred Senegal zebu, humped ox, or Gobra, a Peuhlish variety of the zebu type. This is a heavy-framed breed, with a moderate beef-producing capacity, an average live weight of 750 to 900 lbs. yielding 40 to 42 per cent. dead weight of medium quality meat, not very spotted. The beef-producing capacity of the Moorish or Gabarougé variety is still smaller.

2. The N' Dama or humpless ox, which is of smaller size, but has a better-knit frame and better developed hind-quarters. The beef is of better quality than that of the zebu, and the average weight is 350 to 450 lbs. There are two varieties, the Gaboon and the Niokdo, the latter being the smaller of the two.

3. The mixed type (jakoré, warlé, n'dama-match), resulting from a cross between the two preceding breeds. This type is by no means uniform, as in native cattle-raising the crossing is promiscuous, but on the whole it is a good animal for the butcher, a full-grown bullock weighing on an average 650 lbs.

The distribution of Senegalese cattle is governed by natural conditions and by the zone where trypanosomiasis is endemic. Generally speaking, the N' dama breed is by far the hardiest and the most disease-resisting, and predominates in districts where water is scarce or where trypanosomiasis is prevalent, *i. e.* in the districts round Bakel and Matam, while about Saldé and Podor one meets with zebus as well, and crossbreds most of all. The zebu predominates in the neighbourhood of Dagana, where, on account of adverse local conditions, it remains without much size or muscle, and also in Djoloff and Baol, where the best beef-producing zebu are found. There are crossbreds there also, while in the Mjayes, where Gobras cannot live, only crossbreds and N'damas are to be seen.

Pure bred N'damas are predominant in the Serère Provinces, along with crossbreds, and produce good butchers' beasts, and the same applies to Sine Salum. At Niani-Ule, in Upper Gambia, and in Casamanca, they constitute the whole of the cattle. In Lower Casamanca, stock breeding is difficult, on account of the damp climate.

Senegal does not afford any well-defined stock breeding districts. Stock-breeding is distinct from crop growing, and there is a violent hostility between the two occupations. The negro races of Senegal must be classified into two divisions: first the Peuhls, who are nomadic and pastoral, and secondly the " Toucouleurs ", Serères, Mandingues, Ouoloffs, etc., who have a fixed abode and till the land. Usually, Senegalese herds are subjected to a system of migration.

The centre of Senegal consists of a huge plain, called the Ierlo, intersected in various directions by sort of gulleys. Here are to be found pools and also wells or " seïanes ", dug by hand at those points in the valleys where water is held up in the wet season. It is on this plain that the cattle are pastured during the wet season. As water becomes scarcer, the Peuhls return to the dry-season feeding-grounds ; those from the North, North-East and East reach the banks of the Senegal, those from the West go to Djoloff, and those from Baol, to the Serère Provinces. The young stock do not take part in the migration, but remain in the encampment together with a few milch-cows.

In some regions, as for instance in parts of the Luga district and on the coast in the neighbourhood of Saloum, the herds are stationary. As a rule, the cattle of the Toucouleurs, Ouoloffs, Sérères and the various tribes of Casamanca migrate short distances. The total number of cattle in Senegal may be reckoned at 800 000 head, and there are about 150 000 butcher's beasts.

The methods of cattle-breeding in vogue among the Peuhls, as well as those practised by other natives, are crude to the last degree. They make no provision of forage to feed their stock during the dry season, so when the latter arrives they are in a very bad way, and often lose their beasts, which die of starvation. The only care the native stockbreeders do take is to water their cattle, and even then they do not get as far as selecting suitable pools, so that only too often the stock drink foul, muddy water, swarming with the larvae of parasites. The repeated privations to which they are exposed have at length rendered the Senegalese cattle adapted, so to speak, to enduring thirst. They can go two months with only one drink every two days, or even every three days, according as they may chance to come across a watering-place, and it is no small wonder that with no more care than this the Senegalese cattle give so good a return as they do.

The calves are deprived from birth of part of their mothers' milk, weaned as soon as they can graze, and fed on a bare maintenance diet all their growing period, appreciably retarding their development. It is true that they share the supplementary ration sometimes given to their mothers, but that does not make up for the lack of sufficient milk.

653 – **Karakul Sheep in the Argentine.** — Direccion General de Ganaderia, Buenos Aires, in *Boletin del Ministerio de Agricultura*, Vol. XVII, No. 1, pp. 122-130. Buenos Aires, 1914. SHEEP

The small herd of Karakul sheep established in the mountainous district of Azul was presented to the Argentine Government by the Emperor of Austria in 1911.

They are being bred for the purpose of obtaining a number of acclimatised pedigree rams to be used for crossing with the local or Criolla ewes. By October 1912, 25 dark-fleeced native ewes from Entre Rios had given birth to 13 crossbred lambs, of which 9 were males ; all the lambs inherited the characters of their male parent with regard to colour and curliness of the wool. The experiment was then extended to include 250 ewes brought from different parts of the Argentine, and consisting almost entirely of Criollas with the exception of a few Merinos and Lincolns. The work is being carried out on the San Nicanor estancia belonging to Dr. M. M. Torino, and has resulted in the production of 76 first generation lambs all exhibiting the Karakul fleece ; the crossbred ewes will now be repeatedly crossed with the pure Karakul rams until a herd of pure Karakul sheep is obtained.

Wet, damp soil has proved very disastrous to the pure Karakul sheep, which contracted serious parasitic diseases (strongyles, sclerostomi, tricocephali). Of the total number imported in 1911, consisting of 4 rams and 16 ewes, only 5 ewes were alive in 1913. In the course of these two years 23 pure bred lambs were born, of which 8 died ; both the first and second generation remained true to type without showing any signs of degeneration.

654 – **Fattening Pigs on Cassava.** — Gouin, A. and Andouard, P. in *Bulletin des séances de la Société Nationale d'Agriculture de France*, Vol. LXXIV, No. 4, pp. 481-483. Paris, April 1914. PIGS

The writers, continuing Professor Frateur's experiments in feeding pigs on cassava, made some trials, and found that the method recommended by Professor Frateur might be profitable in Belgium, where cassava is obtainable for 12 or 13 francs per 100 kg. (4*s* 10*d* to 5*s* 3*d* per cwt.), but that it could not be followed in France, where cassava costs 18 fr. the 100 kg. (7*s* 3*d* per cwt.).

With a view to finding a more economic use for cassava, the writers made some experiments of their own, with the following results.

1. In the case of pigs fed with milk as well, it only took 3 lbs. of cassava to produce a gain in live weight of 1 lb., instead of the 4.18 lbs. of cassava required at Louvain.

2. By substituting for the milk ration 1.1 lb. of rice gluten and 2 ½ oz. bone meal, which costs 1*d* and is equivalent to 1 gallon of separated milk, there is required, to produce a gain of 1 lb. live weight, only 2.9 lbs. of cassava.

In practice, the profit exceeded 40 per cent.

Professor Frateur fed the cassava to the pigs in slices, cooked and then crushed. The writers fed it raw. It had been previously chopped fine in the colony itself.

655 – **The Influence of the Male Parent on the Character of the Egg-shells in Fowls.** — WALTHER, A. R. in *Landwirtschaftliche Jahrbücher*, Vol. 46, No. 1, pp. 89-104. Berlin, March 11, 1914.

In an investigation on the heredity of certain characteristics in fowls, it was sought to determine to what extent the breed of the cock influences the weight, shape, gloss and colour of the hens' eggs.

More than 130 eggs were laid by 13 hens, mated, some with cocks of their own breed, and some with cocks of 4 different breeds.

The breeds employed were the following :

I. *Dwarf fowls.*

1. Japanese: 1 cock, 2 hens.
2. Millefleur: 1 hen.
3. Silver-Sebright-Bantam: 1 hen.

II. *Medium-sized fowls.*

1. Huringian "Pausbäckchen": 1 cock, 3 hens.
2. Westphalian "Kruper": 1 cock, 3 hens.
3. "Nackthälse": 1 cock, 3 hens.

All the dwarf hens were reckoned as belonging to the same race, in view of the difference in weight between them and those of medium size. All the hens were first mated with cocks of their own breed; then the cock was removed and an interval of 8 or 10 days was allowed to elapse before he was replaced by a cock of another breed.

All eggs laid during the first mating period and subsequent isolation are reckoned as pure, while crossed eggs are those laid after the 10th day of the presence of the cock of another breed. Between the removal of the first cock and the time when the second cock's influence began to be felt, a space of time elapsed which the experiment shewed to be long enough to make sure that the influence of the first cock had entirely disappeared. The eggs were weighed and measured, and their colour and gloss noted as soon as possible after they were laid, and particulars were only kept of those eggs which proved fertile on incubation.

The results may be summarised as follows : The fact of the cock belonging to a different breed had no influence upon either the weight, shape, colour or gloss of the eggs. The writer therefore casts some doubt on the recent assertions of Holdefliess and Tschermak, in which those writers allege that they have observed in eggs phenomena indicating telegony.

POULTRY

656 – **Seaweed for Packing Birds.** — DEKOBRA, M., in *La Nature*, No. 2134, pp. 339-340. Paris, April 18 1914.

In speaking of the utilization of a species of "mutton-bird", the writer describes a new method of packing; this consists in placing the body in a natural bag formed by the lamina of a certain seaweed occurring in islands off New Zeland. Birds can be kept in good condition for several years in this way.

657 – **Ostrich-farming in New Caledonia** — FRAYSE, A. in *Revue de la Chambre d'Agriculture de la Nouvelle-Calédonie*, No. 39. pp. 26-30 Nouméa, March 1914.

A colonist in New Caledonia has started ostrich farming with nine imported birds. The price of the birds was £ 32 a piece, and the total cost of importation was £ 1000. Ostriches could be had in Austrialia at a price of £ 40 to £ 48 the pair.

658 – **Poultry-Farming in Canada.** — FORTIER, V. in *La Vie Agricole et Rurale*, Year 3, No. 16, pp. 434-435. Paris, March 21, 1914.

The writer describes the excellent results achieved for some years now in Canada with the system of unwarmed fowlhouses. Both from the point of view of preventing disease and from that of maintaining the birds in good condition, experience shews that it is better not to heat fowlhouses in winter. Among other good effects this system increases vitality and laying-power. It is sufficient that fowlhouses should be built well protected from damp, and that, at the beginning of the cold season, the fronts should have sacking or coarse cotton drawn over them, so as to keep out draughts. The fowlhouse should be built facing south, which greatly raises the temperature inside (when the thermometer outside shews 23° below zero Centigrade, the temperature inside will be 3° or 4° C. on a sunny day or 0° to 2° C. on a dull day). The house should be fitted with flat perches, to admit of the fowls covering their feet completely with their feathers. For laying purposes trap-door nests should be used, and should be visited often enough to prevent the eggs having time to freeze. This system has contributed largely to the recent great progress of Canadian poultry farming, the receipts from which have increased, under the encouragement of the Government, from £3 385 000 in 1901 to £7 842 000 in 1911.

FARM ENGINEERING.

659 – **Automatic Lifter for Balance Ploughs.** — DE CONDÉ, FERNAND in *Bulletin de la Société d'Encouragement pour l'Industrie Nationale*, Year 113, Vol. 121, No. 1. Paris, January 1914.

AGRICULTURAL MACHINERY AND IMPLEMENTS

In working with heavy balance ploughs, lifting the shares out of the ground at the end of the furrow is often very laborious. In Bajac's plough the work is done automatically. In fig. 1 the balance plough is shown travelling in the direction of the arrow. To the landside of the frame a sector shaped piece *S* is attached by means of a horizontal axis *x* round which it can revolve. While the plough is proceeding, the sector *S* is kept in the position shown in fig. 1 by a catch. On nearing the end of the furrow the ploughman, without leaving his seat, releases the catch by pressing his foot on a pedal, and at the same time he steers the plough so as to bring the wheel *A* on to the unploughed land. The sector then falls into the position *S*, fig. 2, touching the unploughed land with the point *a* ; the radius of the curve *ab* of the sector increasing from *a* to *b* causes the point *x* to rise as the machine advances and this, combined with the

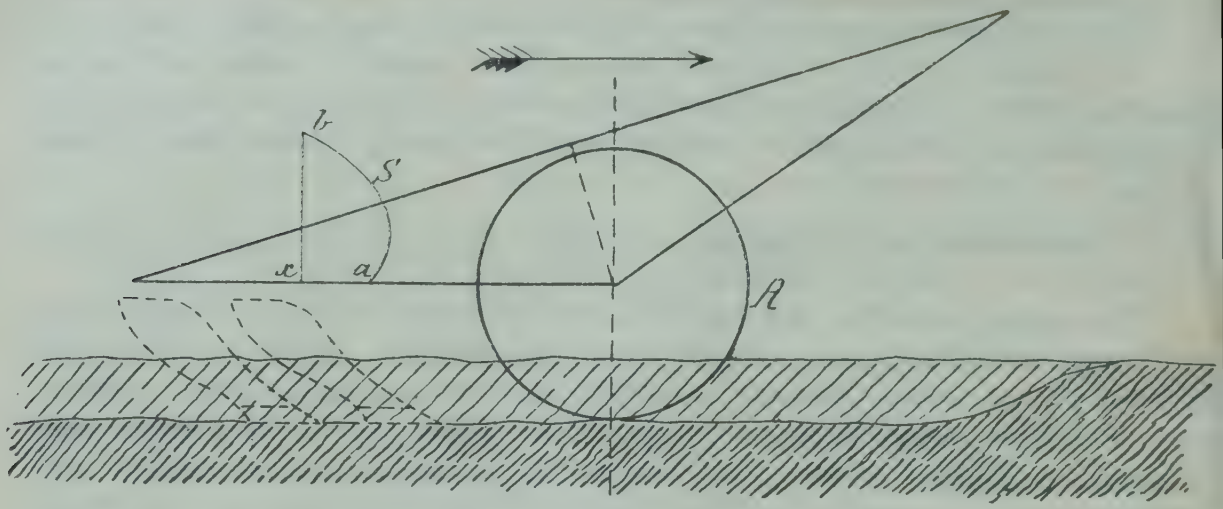


Fig. 1.

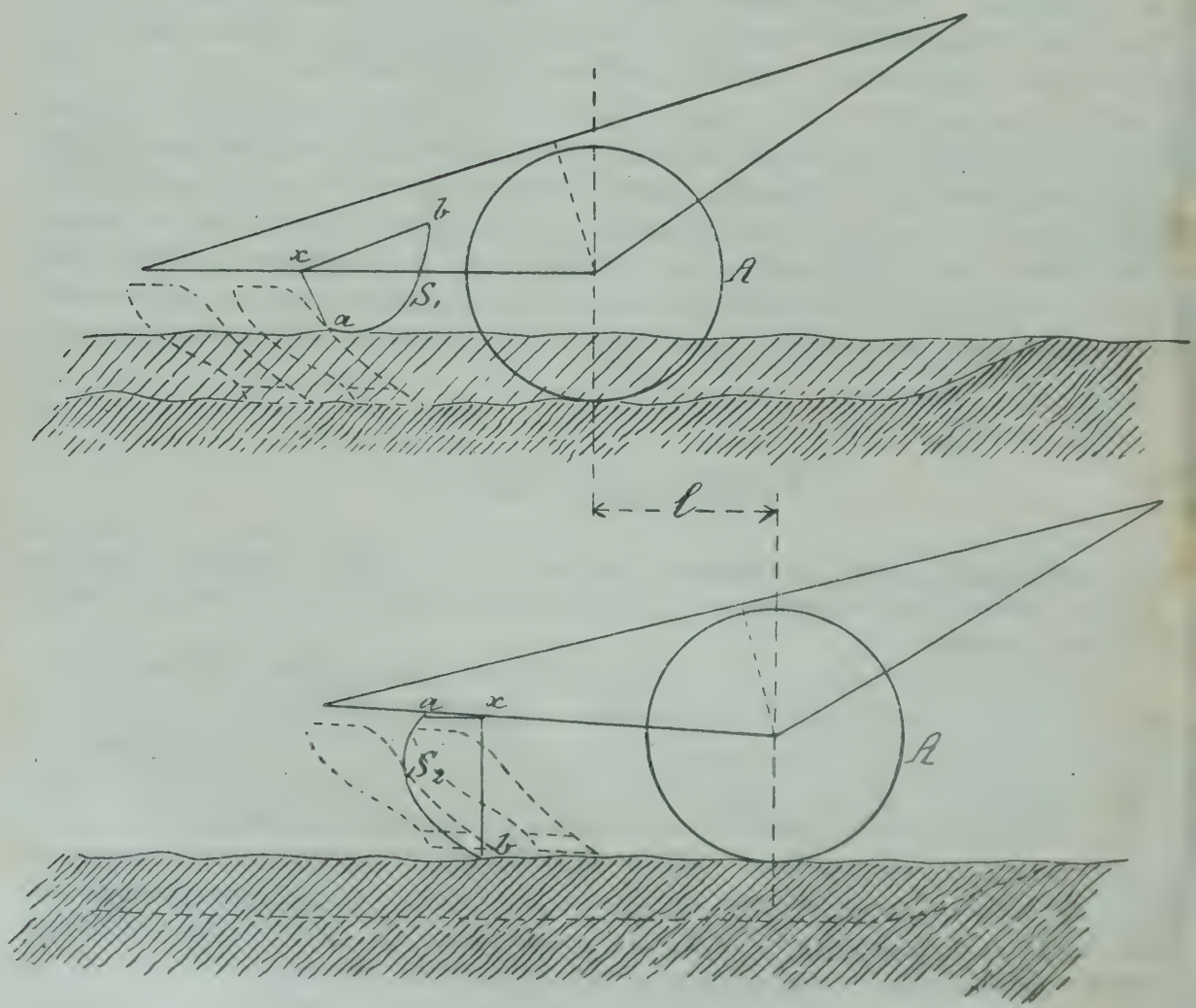


Fig. 2.

rising of the wheel *A* on the land lifts all the shares out of the ground within a length *l* equal to the development of the curve *ab*, fig. 2.

In order to prevent the sector slipping or dragging it is provided with strong projecting cleats.

When the plough is tilted for the return journey the sector is lifted by hand into its original position in which it is caught and fixed by the catch.

660 – **Team-hauled and Self-propelling Motor Binders.** — RINGELMANN, MAX, in *Journal d'Agriculture Pratique*, Year 78, Vol. 1, No. 2, pp. 55-57. Paris, Jannary 8, 1914.

In order to determine independently the power required by motors for working reaping and binding machines, *a*) when self propelled and *b*) when hauled by a team, the writer gives the following data drawn from a number of experiments carried out with various binders working in level fields.

A. The total amount of work done by a binder in travelling, reaping, binding and overcoming the friction of its mechanism ranges on average

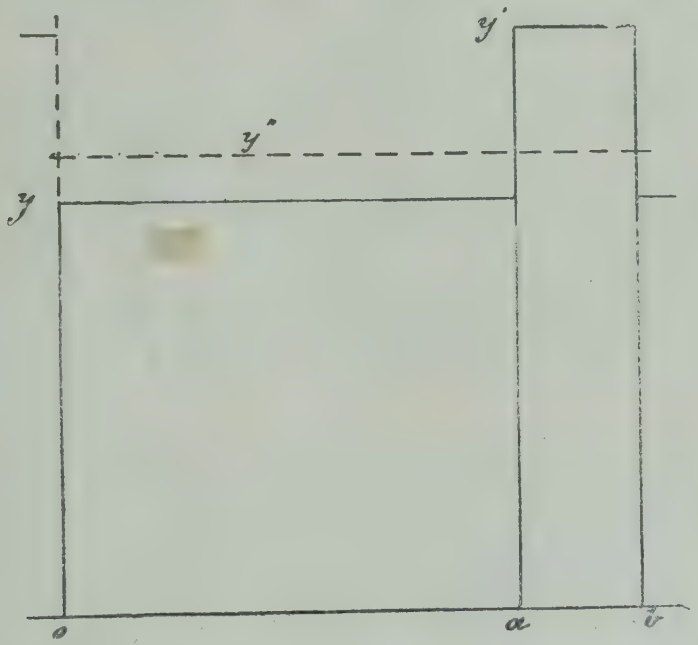


Fig. 1. — Diagram of a cycle of work done by a reaper and binder.

between 656 and 755 foot-pounds per pound of sheaves of wheat, and between 525 and 623 foot-pounds per pound of sheaves of oats.

B. The work of binding a sheaf of wheat weighing 11 lbs. requires an average expenditure of from 330 to 240 foot-pounds, which includes driving the mechanism, packing the cereal, knotting and cutting the twine and discharging the bound sheaf.

C. In machines having a five-foot cutter-bar, working in practice a swath of 4ft. to 4ft. 4in. on the level, and with a crop of about 44 cwt. of sheaves to the acre, the average power varies according to the various phases of the work and may be represented by the diagram, fig. 1, in which the distance travelled by the machine is shown by *oa* and *ab* and the power employed by *oi* and *ay*.

1) For a certain space *oa* the machine works as a simple reaper with elevator; the average traction *oy* is then 343 lbs.

2) At the end of this period there are 11 lbs. of cereals on the binder deck. The binder gets thrown automatically into gear and works while the machine travels from *a* to *b* and requires a power *ay'*, about 495 lbs.

3) The mean for the whole cycle, *i. e.* for the whole distance *ob*, is 380 lbs.

But the power required during the two periods is not constant throughout each period. Its variations are shown in fig. 2.

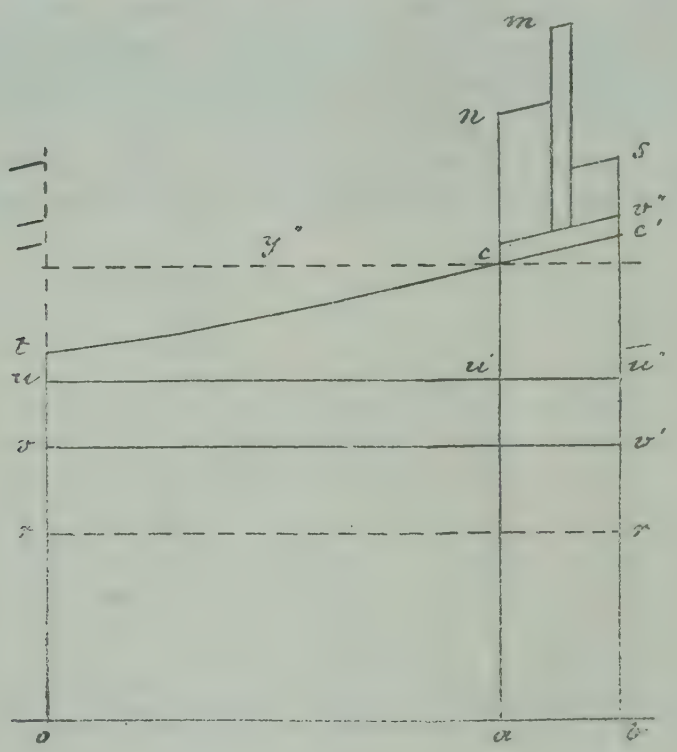


Fig. 2. — Diagram of the variations of power required by a reaper and binder during a cycle of work.

During the first period *oa* (when the binder is not working) the following work is done :

or haulage of the machine.

rv power consumed by the various parts of the machine itself minus the binder running empty. Everything above the line *vv'* represents the work done in passing the cereal through the various parts of the machine; thus *vu* is the work of bending down the grain to the cutter-bar, cutting it and carrying it by the platform and elevator canvasses.

utcu' is the work of the packers up to the moment *ac* when there is enough grain on the deck to throw the binder into gear.

In the second period *ab* there are besides these demands, all those above *cc'* required by the binder proper, to which must be added *u''c'*, or the power which presses the cereal, continually supplied by the elevator canvas, against the back of the needle and the sheaf which is being tied.

cc'v'' the working of the binder proper running empty.

n the average work of the needle and twine going through the compressed sheaf.

m the knotting.

s cutting the twine after the knot has been tied, the descent of the needle and the discharge of the sheaf by the carriers.

The team or the motor have thus to supply during a short time a maximum amount of work shown in *m* in fig 2. In reality the dynamometer diagrams reveal that in some moments the power required is still greater.

D. Assuming however the average traction required to be represented by *y''* in figs. 1 and 2, it has been found that a binder weighing, with its driver, about 1700 lbs., cutting a swath of 4ft. 2in. and dealing with a crop of 44 cwt. per acre, requires an average traction power of :

For the haulage of the machine	169.4 lbs.
For working the machine running empty.	90.2 »
For reaping and binding	121.0 »
average total	380.6 lbs.

which, at a speed of 4 ft. per second, corresponds to about 1502 foot-pounds per second or about 2 $^3/_4$ HP.

Taking the above data as a basis and making due allowance for shocks, sudden strains and maximum efforts, the writer calculates that if the binder is drawn by a team, the motor required to work the reaping and binding mechanism must be capable of developing not less than 4 HP, while if it has also to propel the machine, the motor must be a 14 or 15 HP one, in order to be able to cope with the gradients and inequalities of the ground often met with in fields.

661 – **Rubber-testing Machinery at the Imperial Institute.** — *Bulletin of the Imperial Institute*, Vol. XII, No. 1, pp. 76-79, 4 plates. London, January-March 1914.

It has been felt for some time that the present methods of judging the quality of rubber in the sale room are exceedingly crude and unsatisfactory and that accurate data for comparison can only be obtained by careful scientific investigations.

The best and most trustworthy method of judging rubber is to vulcanise a portion and to submit the vulcanised product to mechanical tests. Some work has been done in this direction, but much further investigation is required before the question of the best method for the preparation of rubber can be solved. Recognizing this fact, the Rubber Research Committee of Ceylon, in cooperation with the Department of Agriculture in the Colony, has arranged with the Imperial Institute to conduct a complete investigation of the effect of different methods of preparation on the quality of the rubber.

For this purpose there has been installed at the Imperial Institute a complete experimental vulcanising and testing plant, consisting of a washing machine, a mixing machine, a three-bowl calender, a vulcanising press, a vulcanising pan, a vacuum drier and a gas-fired boiler, and embodying all the most recent improvements which have been suggested by experience.

For the determination of the mechanical properties of vulcanised rubber one of Schopper's testing machines, which are considered to be among the most efficient, has been obtained. It can be used to determine the breaking strain, the elongation with fixed load, the load required for fixed elongation, etc. The machine is also fitted with an automatic apparatus for drawing diagrams. Other testing machines will be added during the progress of the investigations.

It is anticipated that by these means much light will be thrown on the effect of different methods of preparation on the quality of the rubber, and will enable a method to be selected on the plantations which will produce rubber of the highest possible quality.

662 – **The Motor Plough Trials at Litowitz and at Komotau Hagensdorf.** — WIRTH, HEINRICH in *Mitteilungen des Verbandes landwirtschaftl. Maschinen-Prüfungs-Anstalten*, Year 8, Part 2, pp. 67-79. Berlin, 1914.

In Austria, where the scarcity of agricultural labour is as keenly felt as in Germany, the question of efficient motor ploughs raises a good deal of interest. Two trials of these machines were held in the autumn of 1913, at Litowitz and at Komotau-Hagensdorf in Bohemia, and their results are given at some length in the above paper, from which the following data are taken :

I. *Trial of motor ploughs at Litowitz on medium heavy soil.* — The following firms took part in the trial carried out on September 9 and 10, 1913.

1. JOHN DEERE, with the " Twin City ", 45 HP, 4-cylinder direct tractor, 500 to 650 revolutions, and eight-furrow gang plough. Width of land worked 9 ft. 4 in. Price £1250, including eight-furrow plough.

2. I. H. C., with " Mogul ", 60 HP, 2-cylinder direct tractor, 350 revolutions, with 1 HP auxiliary motor. Eight-furrow Moline gang plough. Width of work 9 ft. 4 in. Price £1167, including plough.

3. HOFHERR-SCHRANTZ-CLAYTON SHUTTLEWORTH, with " Hart Parr ", 60 HP, 2-cylinder direct tractor, 300 revolutions, benzol, oil-cooling, Deere eight-furrow gang plough. Width of work 9 ft. 4 in. Price £1458.

4. ANTON DOBRY, with a 25 to 28 HP, 4-cylinder direct tractor on Saunderson's system, 550 revolutions ; three-furrow Sack plough. Width of work 3 ft. 4 in. Price, £833.

5. ERSTE BOEHMISCH-MAEHRISCHE MASCHINENFABRIK, with the self-contained 32 HP, 4-cylinder motor plough " Praga ", 1200 revolutions, five-furrow Joh. Cervinka ploughs. Width of work 4 ft. 8 in. Price £788 with two sets of ploughs.

6. MÜNCHENER MOTORENFABRIK (Munich-Sendling), with a 30-35 HP 2-cylinder direct tractor, 480-500 revolutions, five-furrow Eberhardt plough. Width of work 4 ft 10 in. Price £646.

7. STOCK-MOTORPFLUG-GESELLSCHAFT, with self-contained 42-50 HP, 4-cylinder motor plough, 720 revolutions, six-furrow Stock plough. Width of work 6 ft. 8 in. Price £1104.

8. CASE THRESHING MACHINE CO., with a 40 HP, 2-cylinder direct

TABLE II.

	Mogul 60 HP.		Hart Parr 60 HP.		Case 40 HP.		Twin City 45 HP.		Stock 42-50 HP.	
Date : September 1913 .	14th	15th	14th	15th	14th	15th	14th	15th	14th	15th
Area actually ploughed, acres	3.46	2.30	3.62	2.43	3.70	2.47	3.70	2.40	3.70	2.47
Inclination of field . . .	partially slightly inclined	level	partially slightly inclined	level	partially slightly inclined	level	level	level	level	level
Fuel, S. G. at 15° C. . .	Benzin 0.723	Benzin 0.730	Benzol 0.861	Benzin 0.732	Benzin 0.736	Benzin 0.737	Benzin 0.734	Benzin 0.745	Benzin 0.733	Benzin 0.732
Net time at work, hours and minutes	2 h. 17 m.	1 h. 51 m.	2 h. 42 m.	2 h. 31 m.	3 h. 5 m.	2 h. 39 m.	3 h. 22 m.	2 h. 30 m.	1 h. 43 m.	2 h. 9 m.
Depth of furrow . . in.	7.09	9.06	7.49	8.27	5.91	5.52 to 7.88	6.03	8.27	6.70	8.51
Breadth of work . . in.	102.36	78.74	53.54	54.72	57.09	50.39	57.09	53.54	80.71	55.51
Number of ploughs working.	7	6	4	4	4	4	4	4	6	4
Speed per sec., ft. in. , .	2 ft. 11	2 ft. 4	3 ft. 3	2 ft. 11	3 ft. 3	2 ft. 4	3 ft. 7	3 ft. 1	4 ft. 9	3 ft. 2
Calculated averages per acre :										
Time, hours and minutes.	40 m.	49 m.	45 m.	1 h. 12 m.	50 m.	1 h. 4 m.	38 m.	1 h. 2 m.	28 m.	52 m.
Fuel . . . . . lbs	29.4	23.55	46.56	44.60	25.42	30.06	32.47	40.59	22.30	23.99
Water for cooling lbs	158.78 (1)	91.88	oil cooling		5.35	12.58	4.73	8.30	2.99	3.12
Performance per day of 10 hours . . . . acres	15.14	12.35	13.49	9.63	11.98	9.34	15.56	9.71	21.49	11.51
Estimated average per day of 10 hours, without interruptious . . acres	16.05	12.35	13.58	11.11	12.35	?	13.58	10.37	21.49	11.61

(1) At each stoppage some water was lost.

tractor, 450 revolutions, Deere six-furrow plough (Inlands type). Width of work 7 ft. 6 in. Price £925, including 6-furrow plough.

All the above machines are provided with differential gear to enable the wheels to revolve independently of each other in turning, and with reversible motion. To prevent skidding most of the engines are fitted with fixed or removeable projecting cleats, besides fixed or removeable fly wheels to enable them to drive other machines. They are all easy to steer.

The object of the competition was to ascertain the amount and quality of the work done, and to this end a large field was divided into eight adjoining plots of the same shape and size, one for each machine. The first day the ploughing was done on the level, in the morning to a depth of a 6 inches, in the afternoon to about 10 inches. The next day (September 10) the ploughing was done on an inclined field. September 9 was a fine sunny day but in the night 0.16 in. of rain fell.

On the first day a wheat and barley stubble was ploughed ; the soil was a medium loam, dry on the surface. Each of the ploughs was given 5.2 acres to plough. The data obtained are given in Table I, and from these the work done per hour and the consumption per acre of fuel and of water for cooling were calculated. In consulting these figures, however, it must be borne in mind that the conditions were not all invariably the same throughout the tests. Thus in the morning the tractors on reaching the end of the furrow lifted the shares out of the ground and returned running empty, while in the afternoon they ploughed all round. Further, in the afternoon several of the outfits reduced the number of ploughs in the gang. The depth of furrow was not the same in all cases. There may also be some errors in the observations, which tell all the more as the duration of the trials was short. As for the quality of the work, the turning over of the soil was good throughout, with the exception of the " Praga " plough, which in shallow ploughing was not satisfactory. Uniformity of depth was attained better by the direct traction ploughs than by the self-contained ones. The loosening and crumbling of the soil was sufficient in all cases, with the exception of the " Praga " in shallow ploughing. Observations were also taken of the appearance of the ploughed land one week after the tests and after a rainfall of 2.2 in.

On the second day, September 10, the field to be ploughed was a wheat stubble, medium loam and sloping towards the south, the gradient being about 9 in 100. To each outfit 2.47 acres of land were assigned. The work done was similar to the deep ploughing of the preceding day. The ploughing in of the stubble was not quite satisfactory, nor was the loosening of the soil, especially in the case of the heavy tractors, which compressed the soil. " Praga ", " Stock " and " München-Sendling " crumbled the soil very well. The traction ploughs required two men each. the self-contained ploughs only one.

II. *Trials at Komotau-Hagensdorf* (*on very heavy soil*). — On September 14 and 15, motor plough trials took place on Herr E. Harsch's estate at Hagensdorf near Komotau. The machines entered were the following ; International Harvester Co's " Mogul " (60 HP) ; Hofherr-Schrantz-Clay-

ton Shuttleworth's "Hart Parr" (60 HP); Case Threshing Machine Co's 40 HP tractor plough; John Deere's "Twin City"; and Stock's motor plough.

On both days barley stubble was ploughed; the heavy humous clay was in good condition with regard to moisture. On September 14 the soil was not quite the same for all the machines, the I. H. C. plough getting the heaviest, the Stock the lightest and the others occupying the same intermediate positions as in Table II. On September 14, each machine was given a plot 3.7 acres in extent, on the 15th 2.47 acres. The resistance of the soil on the second day was very nearly the same for all plots.

The competing machines were to have ploughed to a depth of 6 inches on the first day and 10 inches on the second. On both days the ploughing in of the stubble and turning over of the soil, as well as the loosening of the soil, was satisfactory. The data concerning the performance of the machines are given in Table II (p. 925).

663 - **A Self-Steering Farm Motor.** — WASHBURN, H. J. in *The Scientific American*, Year 70, Vol. CX, No. 15, p. 313. New York, April 11, 1914.

A great need of the country is an efficient helper for the owner of the one-man farm, a machine that will work effectively and make him less dependent upon hired help, while saving him a considerable outlay in wages. Such a system has been devised on a practical basis. It requires compliance with certain conditions which cannot be fulfilled on all farms, but which are an easy matter in some existing ones and in many new localities.

The farm must contain one or more circular areas of any size up to about 10 acres each, reasonably level.

Thus a 10-acre farm would have a 7-acre circle in its centre, the remaining corners, 3 acres in extent, being occupied by fruit trees, buildings, etc. In the centre of the circle the post shown in the figure (facing p. 928) would be permanently erected. At the top of this post, which is strongly guyed, is seen an iron drum. This drum is set and locked by the handle on the side of the standard. Attached to the drum is a slender galvanized steel wire; it passes through a guide pulley and then to the steering lever of the motor-driven implement at some distance away. At each revolution of the implement round the field the wire wraps once roundthe drum, hence the circumference of the drum determines the width of work done. Between the frame and the steering lever of the implement a strong spring is attached, tending to steer the implement away from the centre post. The steering wheel has a deep flange in order to resist side pressure. About two pounds pressure at the end of the steering lever is sufficient to guide the implement. Since the tension of the spring and of the wire opposing it is about 50 lbs., the steering lever is obliged to follow an exact spiral path.

Repeated runs with the implement, starting at a radius of about 200 feet and finishing about 20ft. from the post, showed no visible variation from its course. The steering action was very dependable, requiring no attention whatever.

The framework of the implement is intended to be such as will facilitate the attachment of all the devices used in row-crop farming, such as ploughs, ridgers, cultivators, sprayers, etc.

An improved style of implement has been designed, having motive power applied to both rear and foreward wheels, both of them being pivoted so as to work between closely set rows of plants. The height under the beam is about 3 feet, permitting the cultivition of tobacco, cotton, etc., of that height. A safety device is provided to stop ignition in case of breakage of the steering spring or wire. With a dependable motor two six-hour runs per day *without an attendant* are possible.

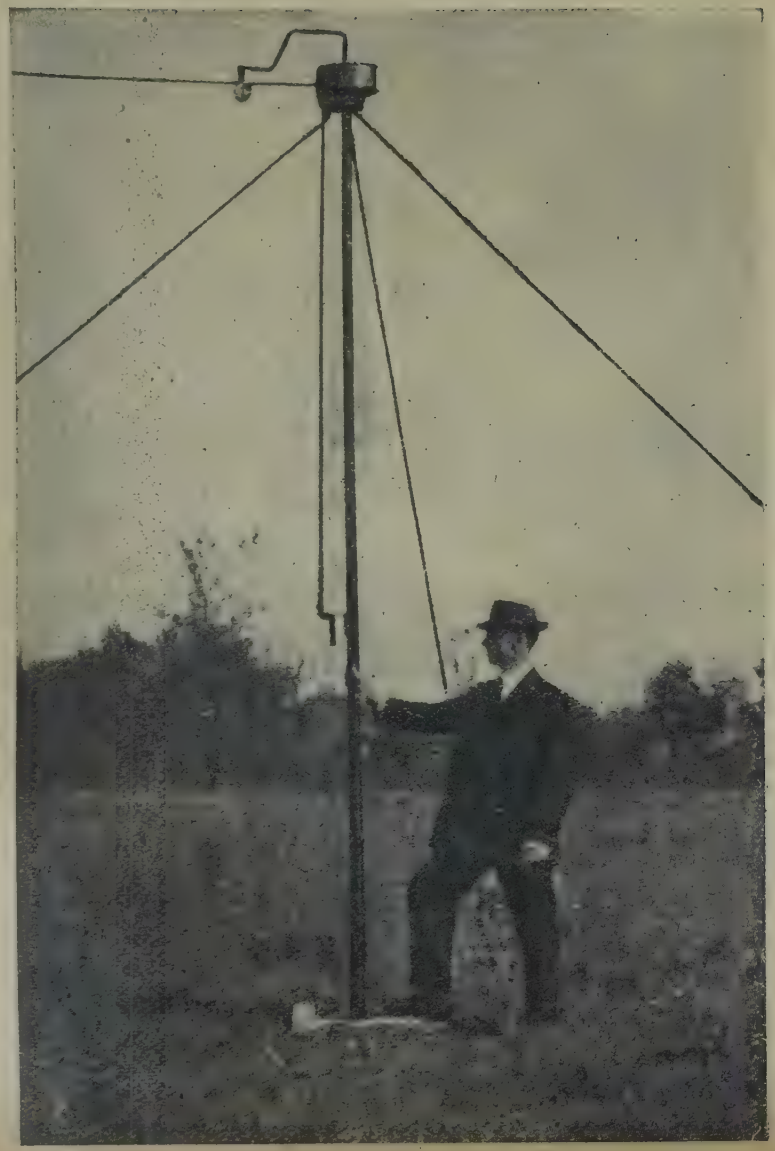
BUILDING CONSTRUCTION

664 – **Foundations on Explosion Piles in Compressible Soils.** — BEAUMONT, P. in *Revue Industrielle*, Year 45, No. 12, pp. 155-158. Paris, March 21, 1914.

Compact and resistant soils allow the foundations of buildings to be laid directly upon them, but such soils are rarely found at the surface; they are generally situated at varying depths and frequently so low down as to be practically beyond reach. In these cases recourse is had to: 1) a continuous simple or reinforced concrete foundation; 2) timber or concrete piles rammed by a pile driver; 3) concrete piles built on the spot.

The first system can be adopted only where the load to be borne is moderate and uniformly distributed and where there is no danger that the ground will be disturbed or undermined; it is, besides, expensive. Timber piles, among other drawbacks have that of being conical in shape and provided with a pointed iron shoe, both of which conditions cause them to tend to sink deeper into the ground under the weight of the building; if, on the other hand, they reach a sufficiently resistant layer they are liable to break under the blows of the ram and thus to become useless. The same defects are met with in the concrete piles driven in by ramming, and these are still more apt to break than the timber ones. Furthermore they require at least three months to set before being used and they are expensive.

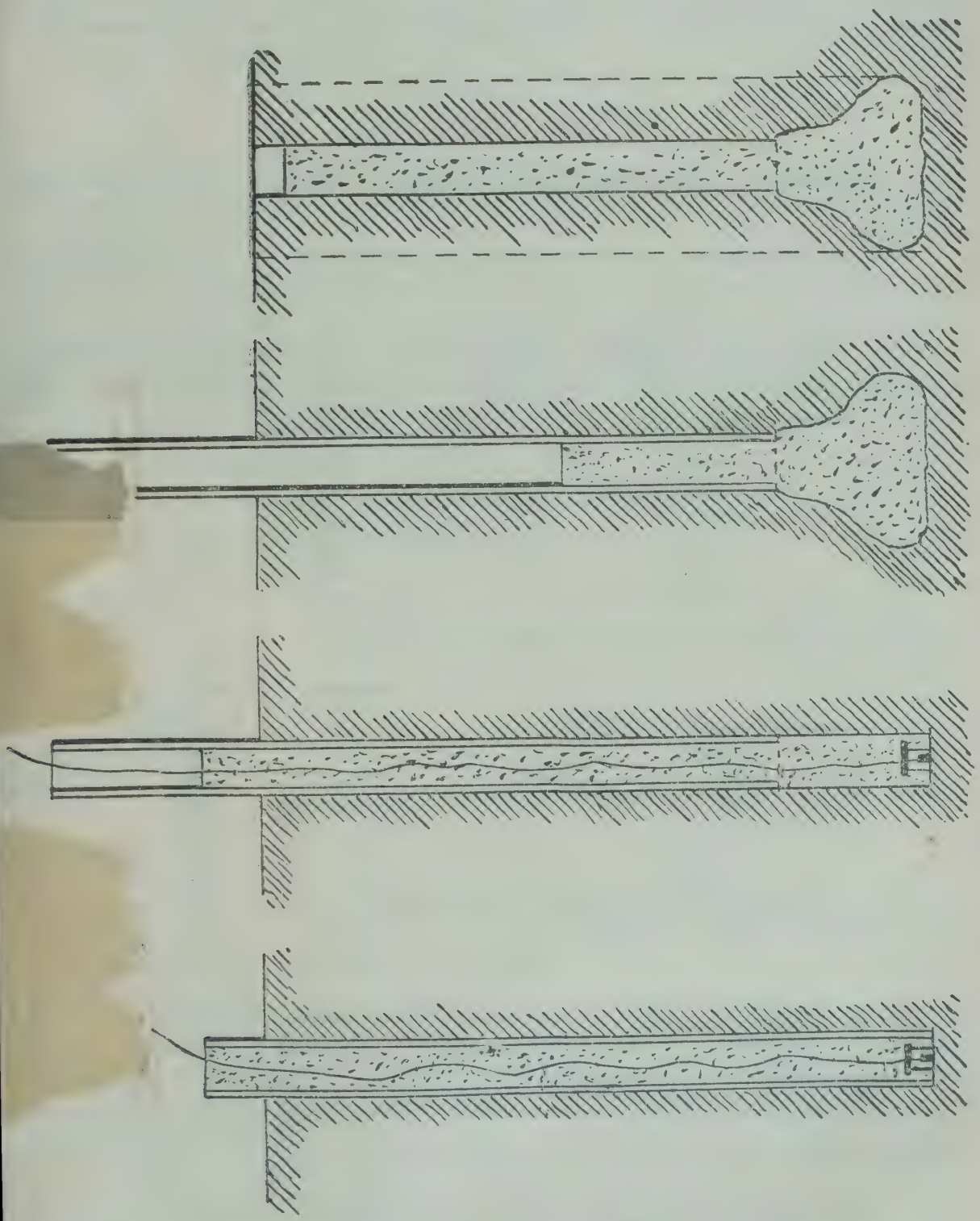
Wherever possible it is therefore an advantage to use concrete piles built where they are to stand, and to replace their pointed extremity by a base much larger than the rest of the pile. With the explosion pile a base having a large bearing surface is obtained together with an artificial compression of the surrounding soil which greatly increases its resistance. These piles are made as follows: a special steel tube encasing a timber pile is driven into the ground to the required depth by means of a pile driver. The timber pile is then withdrawn and the explosive cartridge is let down to the bottom of the hole in a special patented apparatus which has the object of protecting it and of directing the force of the explosion in a horizontal direction. The steel tube is then filled with fresh ce ment concrete (fig. 1) and lifted about 3 ft. 3 in. from the bottom (fig. 2), after which the charge is fired. The concrete sinks instantly and fills the chamber formed by the explosion (fig. 3). All that then remains to be done is to pour concrete into the tube, raising the latter gradually, and at last to remove it altogether, and the result is an explosion pile with a large and resistant base surrounded by, and resting on, strongly compressed ground (fig. 4).



Centre post for self-steering farm motor.
(See No. 663).

Explosion pile taken out of the ground.
(See No. 664, fig. 5).

There is no difficulty in regulating at will the size of the foot of the pile and the compression of the ground around it. The cubic contents of the chamber caused by the explosion are easy to calculate, being equal to the



difference of volume of the concrete in the steel tube before and after the explosion. Thus after a few trials the most suitable charge can be determined. It should be noted that with these piles the foundation is not repre-

sented only by the cross section of the pile, but by the section of the whole heterogeneous cylinder of earth and concrete shown by the dotted lines in fig. 4. If the soil is very bad and the load considerable, several of these piles can be grouped together, in which case the soil around their bases gets so compressed as to approach the hardness of concrete. Fig. 5 (facing p. 928) taken from a photograph of one of these explosion piles.

RURAL ECONOMICS.

665 – **The Economic Limit of Sugar-Beet Growing.** — BERNARD, P. in *Le Progrès agricole*, Year 28, No. 1392, pp. 229-230 and No. 1393, pp. 249-250. Amiens, March 22 and 29, 1914.

One of the most important factors influencing the profitableness of sugar-beet growing is the cost of transport, which depends principally upon the distance the beet has to travel on its way to the factory.

The writer determines the outside limit of this distance at the prices now ruling in France. He endeavours first to ascertain the cost of the "mile ton" of beets. In a farm of 494 acres consisting of:

Wheat	118.5 acres
Other cereals	59.0 »
Beets	118.5 »
Clover	59.0 »
Meadows	99 »
Lucerne	40 »

on a 6-year rotation, the carting is as follows:

	Horse-days	Weight carted
Farmyard manure for beets	432	1 417 tons
Lime and artificials	25	83 »
Liquid manure to the meadows	64	165 »
Cereal harvest	114	566 »
Haymaking, clover	33	165 »
» meadow	20	98 »
» lucerne	150	492 »
Carting sugar beets, mangolds and their leaves	792	5 197 »
Carting cereals to railway	30	110 »
Total	1 660	8 293 tons

If the average distance of this carting be taken at 2 kilometers (1.24 miles) this farm has to provide for 10 283 mile-tons in 1660 horse-days. The farm requires 4690 horse-days for all the agricultural work of the farm, and as the total cost of the upkeep of the necessary teams amounts to £1011, the cost of carting 10 283 mile-tons is $\frac{1011 \times 1660}{4690} = £357\ 16s$, and for one mile-ton $\frac{357\text{-}16\text{-}0}{10\,283} = 8.35\ d.$ If instead of 2 kilometers, 1.5 kilometer (0.9 mile) be taken as the average distance of the carting, other conditions being equal, the cost of transport per mile-ton amounts to 11*d*. The writer therefore considers that he is not far wrong when he assumes

the average cost of transport for a beet farm at 0.60 fr. per kilom.-tonne (9.81*d* per mile-ton).

The average cost of production of sugar-beets per acre is calculated as follows:

	£	*s*	*d*
Rent	1	5	8½
Interest on capital invested, at 4 %	—	9	0
Farmyard manure, 40 tons, of which $^{2}/_{5}$ are debited to the beets	2	11	2
Artificials	2	14	7½
Preparing the soil before sowing	1	0	10½
Value of seed and sowing	—	14	5½
Hoeing and singling	1	2	6
Lifting and loading	—	19	3½
Sundries	—	8	0
Total	£11	5	7½

To this cost of production the cost of carriage has to be added. If the beet crop be estimated at 11.94 tons per acre (30 tonnes per ha.), it means that a weight of 15.13 tons has to be carted to the factory on account of the earth adhering to the beets. At a cost of 9.81*d* per mile-ton, the cost of transport amounts to 9.81*d* × 15.13 = 12*s* 4*d* per mile. Thus the following table has been drawn up, showing the profit or loss per acre of beets grown, according to the distance between the fields and the factory, when the sale price of the beets is 22*s* 3¼*d* per ton.

Distance from fields to factory	Cost of carriage			Total outlay per acre			Profit (+) or loss (—) with an income of 22*s* 3¼ *d* × 11.94 = £13 6*s* p. acre		
Miles	£	*s*	*d*	£	*s*	*d*	£	*s*	*d*
1	—	12	4	11	17	11½	+ 1	8	0½
2	1	4	8	12	10	3½	+	15	8½
3	1	17	0	13	2	7½	+	3	4½
4	2	9	4	13	14	11½	—	8	11½
5	3	1	8	14	7	3½	— 1	1	3½
6	3	14	0	14	9	7½	— 1	13	7½

The point at which beet growing no longer pays lies at a distance between three and four miles from the factory. One means of extending this limit would be the granting of indemnities for carriage, proportional to the distance covered, as is already being done by the Meaux sugar factory. The substitution of mechanical for team haulage would also lower the cost of carriage; two 24-HP motor lorries, whose performance would amount to 48 132 mile-tons in 300 days, would work at a rate of 1.96*d* and 2.42*d* per mile-ton respectively. As the lorries would only have to deal with 10 302 mile-tons and would therefore be utilized during only a limited part of the year, these figures would have to be increased, but even if they were doubled a considerable saving over team haulage would be effected.

666 – **Work and Wages of Foreign Labourers in Prussia.** — GROSSMANN in *Georgine, Land- und Forstwirtschaftliche Zeitung*, Year 7, No. 28, p. 248. Königsberg, April 4, 1914.

The foreign labourers who come for the season are generally put on piece work at hoeing, harvesting, cutting green crops, pulling roots or lifting potatoes. The following are the most usual wages.

	I. With partial board: potatoes, milk and bread				II. With full board			
A. *Hoeing.*	Beets		Mangolds		Beets		Mangolds	
1. Per acre of roots:								
a) First hoeing	3*s*	2*d*	2*s*	4*d*	2*s*	4*d*	2*s*	0*d*
b) Hoeing between the rows	2	4	2	4	2	0	2	0
c) Singling	4	0	3	2	3	2	3	2
d) Second hoeing	4	0	3	2	3	2	3	2
e) Third hoeing	4	9	3	2	4	0	3	2
2. Per acre of potatoes	4*s*	0*d*			3*s*	2*d*		
3. Per acre of grain	4*s*	0*d*			3*s*	2*d*		
4. For work after the horse-hoe the above prices are diminished by 9*d* per acre								
B. *Cutting green crops and harvesting.*								
1. Reaping winter grain, per acre	4*s*	9*d*			2*s*	4*d*		
2. Binding, stooking and carrying winter grain, per acre	4	9			1	7		
3. Reaping spring grain, per acre	2	4			2	0		
4. Binding, stooking and carrying spring grain, per acre	2	0			1	7		
5. When working after a reaping machine the above prices are diminished by 4*d* per acre								
6. Mowing meadow grass, clover, lucerne, serradella or lupins, per acre	2	4			1	10		
C. *Pulling roots.*	Beets		Mangolds		Beets		Mangolds	
1. Roots: Pulling, topping, heaping, clamping, and covering clamps	22*s*	6*d*	14*s*	3*d*	19*s*	0*d*	12*s*	9*s*
The same afer a root-lifting machine	19	0	11	0	16	0	9	6
2. Roots: Pulling, topping, heaping, and either building small clamps for carting or loading on carts	19	0	9	6	16	0	8	0
The same after root-lifting machine	16	0	8	0	12	9	6	6
3. Covering the clamps with earth to a depth of 12 inches, according to the nature of of the soil; per running foot	$^{7}/_{8}d$ to $1^{1}/_{2}d$				$^{7}/_{8}d$ to $1^{1}/_{2}d$			
4. Pulling swedes, as at C2, per acre	9*s*	6*d*			8*s*	0*d*		
D. *Potatoes.*								
1. Digging, per 110 lbs.	$2^{1}/_{2}d$				$1^{3}/_{4}d$			
2. If preceded by the potato-plough, the price is reduced by $^{1}/_{2}d$ per 110 lbs.								

667 – **Cost of Production of Milk and Beef.** — WATERSTRADT, F. in *Archiv für exakte Wirtschaftsforschung*, Vol. 6, Part 1, pp. 137-156. Jena, 1914.

The writer reports certain results of observations made on the cost of production of milk and of meat, and discusses the factors which influence these values in the various systems of farming. In one Table (see Table I) he collects the most important results from seven dairy farms where the farmers raised no stock of their own (Abmelkwirtschaften) and from seven others where they only raised a portion (Halbabmelkwirtschaften). These farms are placed in ascending order of cost of milk production.

TABLE I. — *Results from 7 Dairy Farms where none of the stock was raised and from 7 where some of it was raised.*

No. of Farm	Per Cow per Farm					
	Cost of feeding M.	Labour M.	Gain or loss of flesh M.	Total expenditure M.	Gross return M.	Cost of producing 1 gallon of milk pence
Farms where no stock was raised.						
1	531.2	60	— 1	702	718	6.2
2	512	60	+ 1	641	677	6.7
3	534	58	— 39	695	684	6.9
4	472	57	— 45	634	620	7.0
5	533	57	— 42	682	654	7.25
6	538	53	— 50	703	669	7.6
7	530	55	— 120	768	683	8.4
Average	521	57	— 42	689	673	7.2
Farms where some of the stock was raised.						
1	310	58	+ 16	427	475	5.3
2	316	58	+ 19	446	465	5.8
3	347	65	— 5	468	466	6.2
4	414	58	— 4	553	548	6.4
5	389	65	— 32	550	544	6.9
6	420	53	+ 13	548	468	7.3
7	437	68	— 32	593	507	8.0
Average	376	61	— 9	512	496	6.6

It is seen from Table I that on dairy farms where none of the stock is raised, in spite of the increased cost of milk-production, the cost of feeding and the labour bills are very little changed. On the other hand it is clearly shown that unfavourable results (*viz.* excessive cost of milk-production) are connected with the difference between the cost-price and the sale-price

of the cows. In the case of the dairy farms where a portion of the stock is raised, the chief factors influencing the cost of milk-production are the increasing cost of feeding and the milk-yield.

The results from nine dairy farms where the stock is raised on the farm are collected in Table II.

TABLE II. — *Results from 9 Dairy Farms where the stock is raised.*

Farm	Milk yield gallons	Gross return M.	Gain (+) or loss (—) M.	Cost of production, pence per gallon	Sale price, in pence per gallon	Cost of feeding M.
A	616	723	— 113	10.4	6.3	372
B	670	642	— 36	9.6	7.25	442
C	653	580	— 59	8.5	5.9	401
D	722	661	+ 3	6.9	7.0	438
E	724	672	+ 58	6.3	6.6	347
F	736	661	+ 58	5.4	5.7	303
G	788	891	+ 67	6.2	6.6	350
H	425	365	— 51	10.25	5.5	288
I	434	540	— 186	13.2	5.5	365

The three first farms shew a deficit, a result attributable to the high cost of milk-production. Whether a farm pays depends also on the milk-yield, as appears from a comparison of the figures for B with those for A and C. This interpretation is confirmed by the results from the other farms, of which four, having high milk-yields, realize a profit. The two last farms experience a loss, due to their poor milk-yield. The cost of feeding has also its significance with reference to cost of production. Thus for farms D and F, the gross returns are the same and yet the cost of milk production is very dissimilar. The writer lays stress on the fact that on the four farms where a profit was realized the feeding requirements had been very accurately calculated, the individual rations carefully compounded according to Kellner's tables, and their cost ascertained in each case.

In the second part of his work, the writer gives results from various pasture farms for 1909 and 1910. These results are given in ascending order of the number of head of stock carried per acre of pasture. It will be noticed that the number of head per acre has a marked influence on the gross yield of the pastures, as well as on the net yield and on the cost of production. The last farm, which in 1910 carried 1.6 head of cattle per acre, seems to have been overstocked. The gross yield was no higher, the net yield was lower, and the cost of production went up.

TABLE III. — *Results from Pasture Farms in* 1909-1910.

	Head of cattle carried per acre	Gross return per acre of pasture s.	Net return per acre of pasture s.	Cost of producing 1 lb. live weight d.	Net return per acre for the whole farm s.
1909	0.30	38	7	6.7	— 11
	0.72	86	66	2.7	+ 30
	0.74	88	20	5.0	21
	1.13	141	87	3.2	62
	1.41	152	109	2.5	29
1910	0.45	35	— 11	9.1	11
	0.62	88	43	3.2	35
	0.65	66	38	4.0	25
	0.66	54	39	3.5	39
	0.78	92	55	3.2	56
	0.83	96	55	—	25
	0.95	123	90	3.2	8
	1.62	120	59	3.7	62

According to Strebel's calculations, the cost of rearing a 2-year-old bullock is about £26 and the cost of producing 100 lbs. live-weight is about 54s, in raising young stock.

The writer's investigations on the cost of production in fattening cattle produced the results given in Table IV.

TABLE IV. — *Cost of Production of Fattening Cattle.*

	I 1908-11 Average	II 1908-11 Average	III 1909-12 Average	IV 1907-10 Average	V 1906-11 Average
	d	d	d	d	d
Per head per day:					
General expenses	1.55	1.55	1.52	1.56	1.65
Labour	1.2	0.7	1.1	1.0	0.9
	s d	s d	s d	s d	s d
Purchasing	2 8	2 5	1 5	2 10	2 6
Total outlay	4 0	3 7	2 7	4 11	3 11
Feeding	1 1	1 1	1 0	1 11	1 3
Cost of production per 100 lbs. live-weight	35 7	32 10	40 4	47 6	40 4

The great influence of the cost of feeding and of the difference between cost-price and sale-price in rendering the fattening of cattle profitable or unprofitable should be noted.

Finally, the writer gives the results of Howard and Lehmann's researches on the cost of fattening pigs. The average cost of production varies from 37*s* 6*d* to 40*s* 6*d* per 100 lbs. live-weight.

668 – **The German Imperial Commission of 1912-13 on the Cattle and Meat Trades.** — 1. *Verhandlungen der Gesamtkommission und Zusammenstellung der Sachverständigen Gutachten*, XVI + 468 pp. — 2. *Anlagenband I: Sachverständigen-Vernehmungen*, XII + 99 + 107 + 131 + 103 + 80 pp. — 3. *Anlagenband II: Materialien*, IV + 376 pp. + 11 tables. Berlin, 1913.

In 1912 the German Government set up a Commission of 30 members for the purpose of enquiring into the condition of the cattle and meat trade. The Commission held a preliminary sitting on the 22nd of November 1912, to discuss the scope of the enquiry, and subsequently, up to the 20th ot October 1913, sat on five occasions, each sitting occupying two days, to consider the evidence of 165 experts, including representatives of farmers, cattle-dealers, butchers, cattle valuation societies, and various towns in all parts of Germany. Representatives of the Imperial Government and of the Governments of the different Federated States also took part in the discussions.

The following questions in particular were considered at the various sittings: the determination of the price paid for beasts sold to the butcher; the question of dealers; the slaughter of immature calves; credit in relation to the cattle-trade; dealers' and slaughterers' commissions; the meat trade; meat-selling by stores, shops, and industrial enterprises; long-term contracts; experience with foreign meat, and municipal meat-buying; boards for fixing the price of meat; estimation of prices; organization of information and statistics.

The entire proceedings of the Commission, including the evidence of the experts and the material furnished by the investigations, were collected at the Imperial Ministry of the Interior and published in the three volumes under notice.

We here give only a few results of enquiries made by the Sub-Commission on the relative price of fat stock on the farm and in the market. After some endeavours to make a direct enquiry as to farm prices by general investigation in the country districts, the Sub-Commission soon came to the conclusion that the only way to obtain an accurate idea of the difference between the price on the farm and that in the market was to ascertain from a series of fat stock markets the sale prices of a large number of beasts in the country and the expenses entailed by them between then and their sale in the market. On these lines, therefore, thorough enquiries were made at the markets in Berlin, Dresden, Breslau, Hamburg, Munich, Frankfort-on-Main, Mannheim and Cologne. The whole of the material collected was then arranged in such a way that for each individual purchase the following particulars were ascertained:

1. The price in the country, *i. e.* the sum paid to the farmer.

TABLE I.

Sundry expenses (in marks per head), for cattle sold by dealers.

I Markets	II Transport	III Gratuities	IV Insurance	V Commission on sales	VI Expenses of marketing	VII Total expenses of marketing IV-VI	VIII Total expenses of sale II-VI	IX Loss in weight	X Total expenses VIII + IX
1. *Bulls and Steers:*									
Berlin	11.12	1.11	7.05	6.40	6.42	19.86	31.98	15.85	47.70
Dresden (1)	11.62	1.50	7.73	11.87	6.82	26.42	38.44	13.47	52.57
Breslau	6.95	1.95	5.04	5.48	4.02	13.63	21.38	—	—
Hamburg	8.21	0.30	4.08	9.62	3.07	16.81	25.00	17.44	42.81
Munich (1)	7.24	1.00	4.32	2.77	2.54	9.36	16.96	—	—
Frankfort (1)	7.32	1.67	—	6.35	1.83	4.55	12.76	—	—
Mannheim (1)	5.37	2.50	—	6.26	2.81	8.58	14.91	—	—
Cologne (1)	5.65	2.50	3.00	—	1.76	4.35	10.01	—	—
2. *Cows:*									
Berlin	11.53	1.83	8.75	7.27	5.25	21.27	33.92	14.30	49.35
Breslau	6.99	1.50	6.00	4.33	4.11	13.44	21.93	—	—
Hamburg	8.46	—	8.04	8.68	2.93	21.01	29.47	—	—
3. *Calves and Sheep:*									
Berlin	2.85	0.50	0.75	1.88	1.41	3.47	6.65	2.26	6.04
Dresden	1.83	0.50	0.20	1.45	2.03	3.68	5.75	1.14	6.89
Breslau	0.76	0.50	0.50	0.54	0.70	1.74	3.00	—	—
Hamburg	1.00	—	0.10	1.20	0.70	2.00	3.00	—	—
Munich	2.09	—	—	1.22	0.75	1.97	4.06	—	—
Cologne	3.57	—	—	1.30	2.00	3.30	6.87	—	—
4. *Pigs:*									
Berlin	3.65	—	1.00	1.98	2.10	5.08	8.73	6.98	15.70
Dresden	2.19	—	0.80	1.92	2.48	5.20	7.39	6.93	13.92
Breslau	1.47	0.75	1.00	1.38	2.25	4.63	6.85	—	—
Munich	2.50	—	—	0.55	0.65	1.20	4.50	—	—
Frankfort	—	—	—	1.10	1.25	2.35	3.00	—	—
Mannheim	2.52	—	0.80	1.43	1.15	2.27	4.78	—	—
Cologne	2.59	0.30	0.60	1.73	2.51	4.41	7.07	—	—

(1) Cattle in general.

TABLE II.

Sundry expenses (in marks per head) for cattle sold by co-operative societies.

	I Transport	II Expenses of the Co-op. Society and of insurance during transit	III Insurance	IV Commission	V Market expenses	VI Total market expenses IV-VI	VII Total expenses of the sale II-VI	VIII Loss in weight	IX Total expenses VIII + IX
1. *Cattle:*									
Berlin	10.70	2.91	7.09	7.56	4.88	19.53	31.78	—	—
Hamburg	7.32	1.50	4.09	8.93	3.83	16.68	22.38	—	—
Munich	3.13	0.50	3.38	3.58	3.47	10.43	12.87	—	—
Frankfort	—	1.42	—	6.00	8.50	14.50	15.92	—	—
Mannheim	8.45	1.50	5.00	6.04	3.63	14.68	24.13	—	—
Cologne	1.78	—	3.00	4.39	4.68	11.32	2.30	—	—
2. *Calves:*									
Berlin	1.74	1.98	0.70	1.48	1.40	3.58	7.30	—	—
Dresden	1.81	1.63	0.20	1.58	1.40	3.18	6.62	—	—
Hamburg	1.16	0.28	0.30	2.45	1.12	3.87	4.27	—	—
Munich	1.01	0.46	0.20	1.07	0.77	2.03	3.34	—	—
Frankfort	—	—	—	1.40	1.45	2.85	2.85	—	—
Mannheim	2.80	1.00	1.00	1.52	0.37	2.89	6.69	—	—
Cologne	—	—	—	1.30	1.95	3.25	—	—	—
3. *Pigs:*									
Berlin	2.99	1.57	1.00	2.35	1.82	5.17	9.33	—	—
Dresden	3.90	1.42	0.80	2.59	2.75	6.14	11.46	—	—
Hamburg	0.95	0.36	0.60	1.25	0.65	2.50	3.06	—	—
Munich	1.82	0.78	0.31	0.85	0.69	1.84	3.05	—	—
Frankfort	—	0.40	1.00	2.28	1.03	3.41	3.79	—	—
Mannheim	1.85	1.00	1.00	1.81	0.81	3.62	6.00	—	—
Cologne	—	—	0.60	1.37	2.03	3.37	—	—	—

2. The price in the market, *i. e.* the sum paid by the purchasing butcher.

3. The incidental expenses of the deal.

4. The gain or loss to the dealer.

From these it was discovered that a large majority of the transactions enquired into, at the markets mentioned, resulted in a loss to the dealer by reason of a fall in the price of fat stock. The average sale-price per 100 kg. (220 lbs.) live-weight for cattle (bulls, steers, cows and heifers) did not

usually exceed the purchase price in the country by more than about 5 to 7 marks (1), while in the case of smaller stock (especially pigs) this excess in some cases reached as much as 40 marks. The purchase-price of cattle per 100 kg. generally varied between 90 and 100 marks (45*s* to 50*s* per cwt.) and the sale price between 95 and 110 marks (47*s* to 54*s* 9*d* per cwt.). The purchase price of calves and pigs was mostly near 120 marks per 100 kg. (60*s* per cwt.) and the sale-price averaged about 140 marks (70*s* per cwt.) but here and there rose above 160 marks (80*s* per cwt). The incidental expenses may be seen from Tables I and II.

It was further found that the price on the farm is governed by the price in the market, and not vice versa, and that consequently the farm price may be reckoned by deducting the incidental expenses from the market price.

If this method of calculation does not always lead to exact results, the explanation is to be sought in the great distance often intervening between the purchase in the country and the sale in the fat-stock market, and in the fact that the irregular supply at the markets exercises a great influence on the prices. It has hitherto been impossible to regulate the supply to the markets, and thereby to eliminate its price-raising influence. If the prices have been sent down by a glut on any market, the farmers refuse, on the score of the low prices, to sell their stock to the dealers. The result is that the next markets are only feebly supplied and the prices go up again. Thus great oscillations are observable in the price of fat stock, and these exercise an unfavourable influence on the cattle-trade in general. This unfavourable influence on prices is not exercised by cooperative selling at the fat-stock markets, because in this case the fluctuations of the market recoil immediately upon the producer, who thus makes a smaller profit and cannot afterwards seek to recoup his direct losses, as the dealer does, from the next market.

669 – **Book-keeping Competition for Small and Medium-sized Farms in East Prussia.** — *Georgine*, Year VII, No. 40. Königsberg, May 16, 1914.

The East Prussian Chamber of Agriculture has organised its third book-keeping competition for holders of small and medium-sized farms. Competitors are limited to holders of not more than 100 hectares (247 acres), who either keep the books themselves or entrust them to a member of their household. The accounts must cover a whole year's operations and must include:

1. A cash account, *i. e.* a record of all incomings and outgoings, household and farm expenses being kept as distinct as possible.

2. A household account with a careful record of all goods furnished by the farm.

3. An inventory containing a valuation of buildings, and live and dead stock at the beginning and at the end of the period under consideration.

4. A balance sheet.

(1) The Mark is about 11 3/4*d*, or 23.86 cents.

The total value of the prizes amounts to 500 marks (£ 25). They will be awarded by a special committee made up of members of the Council of Rural Economics and Book-keeping of the Chamber of Agriculture. All data or figures communicated by competitors will be treated as strictly confidential.

AGRICULTURAL INDUSTRIES.

INDUSTRIES DEPENDING ON PLANT PRODUCTS

670 – **Results obtained by the Distribution of Pure Hungarian Yeast Cultures in 1912.** — REQUINYI, G. in *A. m. Kir. Ampelologiai Intézet Évkönyve* (*Yearbook of the Royal Hungarian Ampelological Institute*), Vol. V. pp. 36-39. Budapest, 1914.

One of the most important functions of the zymological section of the Royal Hungarian Ampelological Institute consists in collecting yeasts from the best wine-producing districts of Hungary, for the use of the vine-growers in wine making. This work was begun in 1901 ; the yeasts were taken from the lees of young wines and from the sediments of old wines (1). By 1906 it was possible to commence the selection of primary cultures, that is to say the founding of pure cultures of each kind, starting in every instance by inoculation with a single cell. This was a tedious process, having regard to the enormous number of species which exist (2), and more particularly because it was always essential to regard the matter from the practical standpoint, and to endeavour to obtain species which might exhibit qualities of value for wine making. The aim in studying individual species was to determine :

1. How far yeasts will ferment must of normal composition under conditions of varying temperature (24° to 25° and 6° to 12° C.), and must containing 35 per cent. of sugar.

2. Their power of resisting sulphur.

3. Their vitality, strength and power of forming sediment.

In fact, all the morphological and physiological characteristics which may serve toward the exact classification of the species. The number of primary cultures obtained from the material collected was 976. The study of these cultures produced 73 species, and after subsequent reduction, and elimination of species of no marked value, 54 species were successfully defined and are preserved in a dilute solution of saccharose, representing the Ampelological Institute's " Collection of Species " ; although all the species ferment must of normal composition, each one presents specific characteristics and advantages, suitable for use under special conditions, *e. g.* the production of sweet wines, champagne, membranous growth, etc.

(1) It is important that the yeasts should be collected from the lees, as this ensures obtaining those which have produced the fermentation of the wine, while those found in the wine itself are the yeasts which take part in the after-fermentation.

(2) From 1901 onwards, 341 divisions have been made, producing 73 species, from 20 yeasts collected in the Tokaj district (*Bulletin of the Royal Hungarian Ampelological Institute*, No. 1, p. 56. 1908).

After being carried through the experimental stage, the pure cultures were offered to vine-growers; 24 vine-growers asked for samples of yeasts in 1911, and this number increased to 152 in 1912 and 230 in 1913. The growers were supplied with application forms in which they stated certain working details, and the yeasts best corresponding to the growers' demands were sent to them, soaked on to cotton-wool, together with printed instructions for the use of the yeasts.

The following were the results of the experiments made in this way by vine-growers in 1912 (1):

1. In 65.6 per cent. of the fermentations carried out by the producers, the inoculation of the must was a complete success. The fermentation, clarification, and maturing of the musts treated in this way were effected more speedily and, in the majority of cases, the appreciation in value was estimated at an average of from 5 to 7 crowns a hectolitre (2 *d* to 3 *d* per gall.).

2. In 21.9 per cent. of the cases, the flavour of the wines showed no markedly increased development, but by reason of the quicker and purer fermentation, this development was also more speedy, and the draining-off easier.

3. In 12.5 per cent. of the cases only, no difference was noted between the produce of the inoculated must and that of the control.

Finally, the fact should be emphasized that in no case was an adverse result reported.

The smaller growers worked with from 1 to 20 hl. (22 to 440 galls.) of must, while the others carried out their experiments with 50 to 300 hl., (1 000 to 6 500 galls.) The total quantity of must inoculated during the 1912 experiments may be neckoned at 2300 hectolitres (50 600. galls.).

671 – **Hybrid Wines at the Toulouse Exhibition, 1914.** — PÉE-LABY in *La Vie Agricole et Rurale*, Year 3, No. 21, pp. 581-585. Paris, April 25, 1914.

Exhibitions of wines from direct-bearer hybrid vines have been held for some time now at Toulouse. Of the 60 white wines exhibited in 1914, the following proved the best: Cirere No. 157; Seibel Nos. 880, 4151, 3013 (liable to mildew), 2563, 3021, 2663. Seibel Nos. 2859 and 2677 produced fairly good rose wines. All the varieties mentioned above are entirely free from oidium (powdery mildew). Among the Malègue hybrids, the following were classed as " good ": 469-2, 1157-1, 1063-7, 1647-8, 1879-12, 2064-6, 2094-3, 2328-1 and 2401-4; their resistance to mildew (*Plasmopara*) and oidium is not yet sufficiently ascertained.

The quality of the wines exhibited in 1914 was on the whole better than in 1913. The writer comes to the conclusion that, at a comparatively small cost, white wines could be produced from the above hybrids, which might be consumed alone or blended with other wines or with each other. Many of them could quite well compete with the ordinary French white

(1) The results for the 1913 trials cannot yet be published, as the necessary data, the testing of the wines, etc., are not yet complete.

wines, and some, according to the verdict of the judges at the show, even with the better types.

Of the 120 red wines exhibited, the following deserve special mention: as general blending wines, the less delicate wines among the Seibel hybrids are noteworthy, namely 128, 156, 1020, 1077, 2003, 2007. The following newer hybrids produced quite good, but perhaps rather less full coloured wines: Seibel Nos. 1007, 2052 and 877, Couderc 4401, Le Madone and Couderc 286-68. The following wines were of a very fine red colour, with a good aroma, a delicious flavour, and plenty of fire: Malègue 2219-6, 2054-7, 2161-2, 2359, 1539-22, 2271-1, 2055-15, 1583-21, 391-6, 829-6, 2046-8 and 469-9. For the four last-named, two sprayings form a sufficient protection against mildew, while the others have not yet been sufficiently tested. The following wines, with a normal red colour, are also worth mentioning: Seibel Nos. 1000, 60, 4004, 3011, Bertylle-Seyve 413, Baco 1, Chenivesse 1-11. The exhibition of red wines shews: 1) that excellent blending wines can be obtained from red hybrids; 2) that many red wines, of normal colour, can be used for consumption just as they are. The hybrid blending wines are also very useful for improving the colour of poorly-coloured French wines grown from European vines, or for improving local wines by adding more body to them, on account of their higher content of alcohol and dry-extract. Some of the red wines could even compete, according to the show judges, with some of the better kinds of European wine.

A special section of the Exhibition was devoted to purely blending-wines, and the fact was observed that certain of the hybrid wines, which were unfit for use by themselves, gave quite good results when mixed with other better wines, or even with wines of no great worth in themselves. Some mixtures of good wines far surpassed either of the component wines taken individually. This group of blending wines gave rise to the following observations: to improve red hybrid wines no French white wines of European vintage are needed, because the white hybrid wines, which cost much less, answer the purpose perfectly. For this reason, according to the writer, every vine grower who only grows hybrids ought to cultivate, along with his red kinds, enough white hybrid wines to enable him to improve the quality of his red wines and give them a higher market valne. The mixing of certain red wines with one another produces in many cases also a good article, as was proved by various wines at the show. The greater the number of kinds of wine mixed (and this applies to red wines alone as well as to mixed red and white), the better the result tastes. Hybrid wines with a "foxy" or "grassy" taste (wines that come from hybrids of Lincecumii), should be mixed with hybrid wines which will mask this flavour, while wines having merely a raspberry flavour can, if required, be used alone.

672 – **Influence of Chloroform and of Oil of Mustard on the Alcoholic Fermentation of Grape-Must.** — KLOSS, in *Zeitschrift für Gärungsphysiologie*, Vol. IV, Part 3, pp. 185-193. Berlin, April 1914.

In order to preserve a sample of unfermented must for the purpose of submitting it subsequently to chemical analysis, chloroform or oil of mustard is sometimes added.

As a result of experiments on the action of these substances on ferments and on the fermentation of grape-must, the writer found that by adding 1 cc. of chloroform to 500 cc. of must, sterilized and inoculated with pure cultures of yeasts, the fermentation was arrested, but the multiplication of the yeasts was not entirely checked. Must inoculated with pure cultures of yeast 12 days old only fermented slightly and for a short time. With 6-day-old pure cultures the must did not ferment at all. This yeast thus showed itself less resistant than the older culture. At the end of the experiment the younges yeast cells had for the most part died out, while those of the 12-day-old yeast, though deprived of glycogen, survived for the most part, and, when introduced into ordinary non-sterilized must, fermented it, which was not the case with the former cells.

Oil of mustard has a much more vigorous action, seeing that even 3 drops in 500 cc. of must checked not only the fermentation, but also the reproduction of the yeast. All the yeast cells were dead at the end of the experiment.

A second series of experiments was undertaken with non-sterilized must in various stages (fresh-pressed, slightly fermented and highly fermented). In this case also, oil of mustard was the more effective, 10 drops in a litre of must being enough to arrest the fermentation completely, a result which was not achieved even on adding 2 cc. of chloroform. The addition of chloroform seems to have checked the multiplication of this yeast more in this experiment than in the preceding.

A further esperiment proved that the development of *Penicillium* was arrested by 5 cc. of chloroform or by 14 drops of oil of mustard per litre of must.

673 – **Co-operative Distilleries in the Pays de aux, France.** — BERTHAULT, PIERRE, in *Comptes-Rendus de l'Assemblée Générale de* 1914 *de la Societê des Agriculteurs de France*, pp. 653-656. Paris, May 15, 1914.

In the Pays de Caux, where the soil is remarkable for its fertility and carries wheat and sugar-beets well, the small size of the holdings places a considerable difficulty in the path of establishing industries requiring a large outlay of capital on the part of agricultursts.

It is due to the activity of the Director of Agriculture for the Seine Inférieure that co-operative distilleries have been formed. Of these there are at present four, situated at Raffetot, Anneville-sur-Scie, Fauville and Yvetot, all definitely co-operative in character. The distillery at Raffetot, which has the fewest members, comprises 16 producers and works 310 acres of beets. All these establishments employ exclusively the sugar-beets grown by their members. The latter, on the other hand, undertake to deliver to the distillery under the best possible conditions

all the sugar-beets they grow, and to put every year to beets a minimum area determined for each farm. The capital amounts to £2 660 at Raffetot, £3 560 at Anneville, £3 000 at Yvetot, and £3 200 at Fauville, each divided into £2 or £4 shares. The balance of funds required is advanced by the State, through the district Treasury of Upper Normandy, in the shape of a loan, as laid down by the Act of 29 December 1906.

The seed for the beet crops is distributed to members by the distillery, and deducted from their share of the profits at the annual settlement of accounts. The roots, when pulled, are sent to the factory, weighed and tared under the usual regulations, and the pulp is returned to the owners, in proportion to the weight of roots supplied. This pulp is taken back at half a crown per ton.

The administration of the Society is in the hands of a Board made up of at least 10 of the members, which superintends and controls all the commercial undertakings of the Society. At the end of each season, it divides the proceeds from the sale of the alcohol among the members, in proportion to the quantity and sugar-content of the beets contributed by each of them. Two deductions are first made to cover the repayment of the capital and the State loans.

The plant is, for the most part, on the Wauquier diffusion system, made to deal with from 60 to 70 tons of roots a day, at 6 degrees density, producing a very strong phlegm (92 at the least). The Anneville distillery is the only one fitted with Egrot machinery.

At the end of the first season at Yvetot, each member received an average of £41 10*s* per acre or £1 6*s* 5*d* per ton of beets.

674 – **Potato-drying Works in the German Empire in 1908-09, 1909-10, 1910-11.** — *Vierteljahrshefte zur Statistik des Deutschen Reiches, Ergänzungsheft zu* 1913, III: *Die Ergebnisse der deutschen Prnduktionserhebungen,* p. 76. Berlin, 1913.

In the following statistics the year commences on August 1 and ends on July 31.

During the three years 1908 to 1911 the potato-drying works in activity were respectively 170, 254 and 327. Of these 114, 167 and 216 were attached to farms or other agricultural undertakings ; 40, 65 and 94 were cooperative concerns (among which those having the form of joint stock and limited liability companies and the like are included) ; 7, 9 and 7 were independent undertakings and 9, 13 and 10 were attached to independent industrial concerns.

In the 170, 254 and 327 works, 170, 254 and 331 drying plants were at work. Among these, 140, 208 and 270 were cylinders ; 22, 36 and 54 were drums ; 7,9 and 6 were of the hurdle type and 1 was a press. As source of heat, 143, 209 and 273 used steam and 27, 45 and 58 the products of combustion. Some of the works, namely 82 in 1908-09, 143 in 1909-10 and 181 in 1910-11, worked with day and night shifts of 12 hours each.

The following table gives further details concerning the works and their produce.

	1908-09	1909-10	1910-11
Total number of works	170	254	327
Number of works that use peeled potatoes:	6	8	4
Of the above, strips and slices are made in	3	5	1
» flakes » »	3	2	2
» flakes and meal » »	—	—	1
» strips, slices and meal »	—	1	—
Number of works that use unpeeled potatoes:	164	246	323
Of the above, strips and slices are made in	25	39	52
» flakes » »	133	197	260
» crumbs » »	2	2	2
» flakes and meal » »	3	5	3
» flakes and crumbs » »	1	1	1
» flakes and strips » »	—	—	1
» strips and meal » »	—	—	4
» strips and groats » »	—	1	—
» strips, slices and groats »	—	1	—
	tons	tons	tons
Total quantity of potatoes treated	157 483	327 053	410 624
For the works themselves	147 200	286 735	369 003
Potatoes produced by the works	97 775	184 320	267 227
» from other sources	49 424	102 415	102 268
» produced in the country	48 795	99 725	99 384
» » abroad	629	2 690	2 884
For outsiders	10 643	40 318	41 621
Total amount of dried product per annum	40 875	86 119	105 507
For the works themselves, total	38 024	75 478	94 780
Strips and slices	5 243	11 512	10 340
Flakes	31 154	62 267	83 112
Meal	1 484	1 438	1 028
Crumbs, and other products	143	262	294
For outsiders	2 851	10 640	10 732
Strips and slices	1 115	4 168	3 872
Flakes	1 736	6 378	—
Flakes and meal	—	—	6 860
Other products	—	94	—
Sale of products made by the works for themselves	38 874	71 431	95 755
To themselves	10 069	17 889	21 308
Strips and slices	1 805	3 916	4 982
Flakes	8 176	13 852	16 131
Meal			61
Crumbs and other products	87.5	115	135
To others, in the country	27 363	52 072	73 958
Strips and slices	3 366	5 637	5 847
Flakes	—	—	67 118
Flakes and meal	23 942	46 333	—
Meal and crumbs	—	—	943
Crumbs and other products	55	107	—
To others, abroad	1 441	1 465	488

675 – **The Value and Use of Millet Malt.** — HÉRICS-TÓTH, J. VON and OSZTRÓVSZKY, A. VON (Royal Hungarian Distillery Experiment Station, Gödöllö) in *Kisérletügyi Közlemények*, Vol. XVII., No. 1, pp. 35-44 + 2 plates. (Summary in German, p. 45). Budapest, January-February 1914.

Millet malt has the same value as barley malt. In malting the only difference is in the steeping: millet may stay in the vat until it has absorbed its full amount of moisture by alternate steepings and exposures to the air, or it may afterwards take up the moisture still required by being sprinkled. In the first case the grain is steeped for 5 to 7 days ; during the process it increases in weight by 35 to 50 per cent.

The disadvantages of millet are its extraordinarily high content of dirt, grass seeds and grains that do not germinate; also it is frequently covered with smut (*Ustilago destruens*). It is advisable to clean it before washing it. The really floating grains are not easy to recognize.

In order to prevent the formation of mildew, the steeped grain is daily ventilated once or twice. The temperature in the sweating heap should keep below 30° C. (86° F.). The best temperature for malting is from 18° to 23° C. (64° to 73°. F.). Lower temperatures lengthen the operation without other inconvenience. The sprouting grain is heaped at first to a depth of 8 to 12 inches and gradually reduced to 4 in. It is advantageous to wash the malt when ready.

In comparison with other grains, the production of the necessary enzymes takes place with loss of matter. The saccharification and liquefying capacity, according to Effront and Lintner, are smaller than in barley and rye malt, but greater than in maize or oat malt. In brewing, millet malt has some very valuable properties: it prevents frothy fermentation; the ratio between the maltose and dextrin formed, the final fermentation and the production of alcohol are good. Probably in the various grains the structure of the saccharification enzymes is the same, and the cause of the lower Effront and Lentner values does not lie so much in the greater or lesser capacity of producing enzymes as in the want of an agent (co-enzim, enzim, etc.) to increase the diastatic power of the various kinds of malt over pure and soluble starch. This agent is, however, contained in sufficient quantity in the various raw materials used in the mashes. With the analytical method, according to which less malt is taken than is required for the saccharification of the mash, the differences in the malts become apparent. The curve of the formation of diastase in millet resembles that of maize ; after attaining the highest value of diastatic power it sinks rapidly.

INDUSTRIES DEPENDING ON ANIMAL PRODUCTS

676 - **The Influence of the Fat Content of Milk upon the Rapidity of Coagulation.** — KREIDL, ALOIS and LENK, EMIL in *Biochemische Zeitschrift*, Vol. 63, Parts 2 and 3, pp. 151-155. Berlin, May 28, 1914.

In estimating the coagulating power of rennet, it is generally accepted as a law that the quantity of ferment used multiplied by the time required to obtain coagulation is a constant. This law is, however, modified by numerous factors, such as temperature, neutral salts, lime-precipitating bodies, alkaloids and more especially by the previous treatment of the

milk. The writers have shown that the rapidity of coagulation of a sterilized milk could be so diminished that often after 24 hours no coagulation had yet taken place. When, however, a non-sterile rennet or an incompletely sterilized milk was used, coagulation immediately set in. The writers observed also that when previously treated milks containing different amounts of fat received the same quantities of rennet, coagulation did not set in at the same time.

These experiments were recently repeated by the writers with five different milks containing respectively 1, 3, 10, 16 and 30 per cent. of fat. The milks were placed in test tubes kept at 40° C. (104° F.) in a water-bath. A fresh 1 per cent. neutral filtered solution of Grübler's rennet was used. Every five minutes the test tubes were taken out and examined for changes in the milk; all five were examined at the same time.

In the first experiment, in which 1 cc. of rennet solution was added to 10 cc. of each of the undiluted milks, no difference in the rapidity of coagulation was observed. In the next experiment, in which each of the milks was diluted with 50 per cent. of water, it was found that the lower the fat content of the milk, the more rapid and complete was the process of coagulation.

677 – **Purification and Disposal of Waste Water from Dairies**. — DORNIC, DAIER and VIGNEROT, in *Annales de la Science Agronomique*, Year 31, No. 4, pp. 150-170. Paris, April 1914.

The waste water from dairies cannot be allowed to flow into streams, rivers or the subsoil without first being purified. In France, the Act of 1902 imposes on local authorities the obligation to make bye-laws dealing with the question in their districts. Another Act, at present in course of preparation, is to deal with drainage into non-navigable rivers.

The process of purification employed varies naturally with the composition of the waste water, which in its turn depends on the type of work carried on in the dairy. From this point of view dairies may be divided, into four classes:

1. Dairies which receive milk from farms and forward it on to towns, with or without pasteurizing. These dairies produce a volume of waste water equal to half the milk dealt with, and proceeding chiefly from the washing of cans, machinery and receiving platforms.

2. Dairies where the milk is used for making cream, butter and cheese, but where the whey is returned to the farmers, after the casein has been extracted. Such dairies use a volume of water about equal to the amount of milk dealt with.

3. Dairies where pig-fattening is practised. These have to dispose of a volume of water about 2 to 2½ times that of their milk.

4. Dairies which extract the casein from the whey and discard the casein with the waste water. In these the outflow of water is double the volume of milk dealt with. This class is tending to disappear, as being economically unsound, seeing that pig-rearing pays 2*d* to 2½*d* per 10 galls. for whey with the casein removed, which is wasted in dairies

of this class. Besides, the waste water from them can only be purified by a biological process, which is exceedingly long and troublesome.

The composition of the waste water from a given dairy varies with the circumstances and the individual dairies. The range of possible variations is given in Table I.

TABLE I. — *Composition of waste water in mgm. per litre.*

	Water in which milk-cans have been washed (Kattein and Schoofs)	Bömmer	Calmette	Daire (water from butter factories)
Capacity for oxidation in mgm. of potassium permanganate per litre	754.7	126 to 4076.4	—	550 to 3050
Organic nitrogen	24.5	7 to 118	43.6 to 115	15 to 130
Organic substances	300.7	253 to 2733	1550 to 2135	215 to 1763
Fatty substances	from 159 to 290	—	628 to 1440	80 to 739
Milk-sugar	—	traces to 731	—	traces to 0.509

The waste water decomposes quickly, especially in summer, and gives off a foul smell due to the putrefaction of the casein and the albuminous matter. The milk-sugar is not present in a large enough quantity to be harmful, and besides, the acid fermentation which it undergoes would rather tend to delay proteolytic fermentation. Fatty matter decomposes very slowly. The chief object to aim at, therefore, is the reduction of the casein, and as this substance decomposes fairly rapidly, prompt action is required.

There are there different kinds of processes of purification: chemical processes, biological processes, and the filter-bed method. The last is the most suitable in the majority of cases. A chemical process recently invented by Daire seems to have a great future before it, and is described below in detail.

Chemical processes. — Considerable reduction of the nitrogenous matter in the waste water from cheese factories has been obtained with the use of the following substances (Table II):

TABLE II. — *Reduction by chemical means of the nitrogenous matter in the waste water from dairies.*

Reagents	Percentage of nitrogenous matter removed
Aluminium sulphate + lime	69.6
	67.5
Perchloride of iron + lime	25.8
Ferrous sulphate + lime	67.5
Ferric sulphate + aluminium sulphate + lime	75.3

Reduction in bacterial content was also obtained by adding 2.3 gm. of ferric sulphate per litre to water containing organic matter, but this process, in addition to being more expensive than the foregoing, gives a residuum which cannot be turned to account.

Hamilton's method, though extremely ingenious, unfortunately scarcely admits of application to commercial use. It is carried out by means of two masonry reservoirs. In the first of these the water is heated for 24 hours by means of a coil; a part of the albuminoids is precipitated by lactic, butyric and acetic fermentations. In the second, thick lime wash and sodium silicate is added; calcium silicate is formed, and carries off the albuminous matter in solution. The precipitate may be used as a manure, and the clean water can be drained into a river.

Daire's new chemical process, in use at the co-operative dairy at Courçon d'Aunis (Charente Inférieure) requires the following plant: *a*) a cylindrical decanting-basin, of about 350 cu. ft. content, in which decantation is effected by a system of outlet pipes flush with the level of the deposits inside the basin; *b*) a filter basin made of reinforced concrete, 6 ft. across and 31 in. deep, containing a bed of coarse slag, covered over with a layer of turf; and *c*) various accessories (a cement gutter, a pump and chute for waste water, a stirrer, etc.); the whole costing about £80.

The process is as follows: First, calcium superphosphate (6 ½ lbs. per 100 cu. ft. of water to be treated), is spread over the bottom of the basin; then the waste water is forced into the basin as fast as it is produced. When it is all in, milk of lime (which must not contain carbonate) is thrown into the basin, in just sufficient quantity to neutralize the phosphoric acid. In practice, it can be seen when this quantity has been reached by the liquid in the basin turning pink. An excess must not be given or albuninous matter will be dissolved. During the operation, stirring takes place by means of a stirrer consisting of a perforated iron disc on a long handle. When the mixing is complete, it is allowed to remain for 3 hours at least, after which the clear liquid is decanted and the deposit sent to the filter basin. It is convenient to arrange for the filtration to take place at night. The operation must be performed once in 24 hours.

This process, which has given complete satisfaction for a year at Courçon d'Aunis, is cheap, requires only a small amount of labour and makes use of easily obtained and inexpensive materials (superphosphate, lime and turf). The turf manure taken from the filter basin undergoes very active nitrification owing to the presence of the lime, and exhibits the composition shewn in Table III.

TABLE III.

Composition of turf manure from filter basins (average of 14 analyses).

Water	80.2 %
Organic nitrogen	0.38 »
Inorganic »	0.27 »
Mineral substances	5.85 »
Phosphoric acid (P_2O_5)	0.77 »

It will be noticed that this manure contains as much nitrogen and phosphoric acid as farmyard manure. Its value is therefore considerable, and in fact easily repays the cost of setting up the plant.

Biological processes. — Anaerobic fermentation in septic pits is suitable for dairies of the first three classes. For water rich in serum, the plant is complicated and costly, in addition to which the standard of intelligence obtaining among persons engaged in the dairy trade makes the method somewhat inapplicable. Oxidation in bacteria beds may be continuous or intermittent, the former being the more perfect. Water rich in serum requires previous neutralization and a more complex plant. Purification by irrigating growing crops is the most economical method and is the right one to employ wherever there is a large enough area and a sufficiently porous soil. Stagnation must be avoided, and too much water must not be allowed to soak into highly porous soil, for fear of polluting the underground water supply. Suitable crops for receiving such irrigation are forage crops, osier beds and vegetables.

678 – **The Activity of Cooperative Dairies in Hungary in 1911-12.** — Extract of Report in the Statistical Yearbook on the activity of the Hungarian Government in 1912, in *Volkswirtschaftliche Mitteilungen aus Ungarn*, Year IX, No. 2, pp. 194-196. Budapest, February 1914.

At the end of 1912, 528 cooperative dairies were working, or 26 less than at the end of 1911. Of these

335	or 63	per cent.	were	founded	in 1896-1905
121	» 23	»	»	»	in 1906-1910
40	» 8	»	»	»	1911
20	» 4	»	»	»	1912
12	» 2	»	»	»	before 1896

Comparative data for the years 1911 and 1912 are given in the adjoining table.

		1911	1912
No. of members		57 436	55 777
No. of cows registered		97 658	91 515
Total amount of milk received	million galls.	21.5	22.8
Av. annual yield per cow	galls.	220	250
Produce sold :			
Whole milk	million galls.	6.92	9.25
Cream	galls.	255 000	300 000
Butter	metric tons (1)	2 100	2 400
Cheese	» »	1 869	2 103
Other produce	» »	10 200	1 700

During 1912, 57 of the dairies received Government grants amounting to £3086, fourteen received grants from local authorities and four received grants from other sources.

(1) 1 metric ton = 0·9842 long ton.

679 – **A Review of Beef Production in the United States.** — MUMFORD, H. W. and HALL, L. D. — *University of Illinois Agricultural Experiment Station, Circular*, No. 169, pp. 1-28. Urbana, Ill., September 1913.

Cattle fattening was first practised in the United States at the beginning of last century. Starting in the State of Ohio it gradually extended westward over Kentucky, Indiana and Illinois, while at the same time the grazing industry spread northward from Texas over the great western plains. Then in the second half of the century, after the Civil War, an increased demand for beef in the East together with improved facilities for cattle transport stimulated the production, and the industry gradually extended westward with the building of the raliways and the introduction of the refrigerator car.

The cattle census per decade is given in Table I, together with the ratio of the cattle to the population.

TABLE I. — *Number of cattle per decade and ratio of cattle to population.*

Year	Total cattle	Cattle other than milch cows	Increase in total cattle, per cent.	Total cattle, per capita	Cattle other than milch cows, per capita
1870.	25 000 000	15 000 000	—	0.64	0.39
1880.	33 000 000	21 000 000	+ 32	0.66	0.42
1890.	53 000 000	37 000 000	+ 60	0.84	0.59
1900.	68 000 000	45 000 000	+ 28	0.89	0.66
1910.	62 000 000	41 000 000	— 10	0.67	0.45
1912.	58 000 000	37 000 000	— 7	—	—

The number of cattle increased up to 1900 and then decreased, but the decrease shown in 1910 is in reality less than would appear from the figures, as the census in that year was taken on April 15 instead of on June 1, which had been the customary date previously, and it is estimated that 5 to 6 million calves are born between those two dates. Even making allowance for this, the decrease is significant, especially when considered in relation to the increasing population. A natural consequence of the decline has been a diminution of the surplus available for export, as shown in Table II.

The numbers and percentages of the various classes of cattle in April 1910 are given in Table III together with the average value of the animals of the different classes.

Almost two-thirds of the cows of breeding age are designated as dairy cows, the remainder being kept mainly for raising beef calves, and the dairy cows are worth almost $12 a head more than the beef cows. The ratio of bulls and steers to cows and heifers is 1 : 1.46.

TABLE II. — *Surplus of cattle available for export.*

Year	Value of all cattle other than milch cows	Value of exports of beef cattle and beef	
		Absolute	Relative
	$	$	per cent
1870	290 491 000	2 693 000	0.9
1880	341 761 000	31 544 000	9.2
1890	560 620 000	53 170 000	10.0
1900	689 486 000	68 407 000	9.9
1905	661 571 000	72 435 000	10.9
1908	845 938 000	55 466 000	6.6
1910	917 453 000	24 400 000	2.7
1912	790 064 000	14 602 000	1.8

TABLE III. — *Cattle classified by age and sex,* 1910.

	Number	Percentage	Av. value per hea
			$
Calves born after Jan. 1, 1910 (under 3 ½ months)	7 806 539	12.6	6.66
Steers and bulls born in 1909 (3 ½ to 15 ½ months). . . .	5 450 289	8.8	26.66
Steers and bulls born before 1909	7 598 258	12.3	
Heifers born in 1909 (3 ½ to 15 ½ months)	7 295 880	11.8	14.14
Cows and heifers not kept for milk, born before 1909. . . .	12 023 682	19.5	22.39
Cows and heifers kept for milk, born before 1909	20 625 432	33.4	34.24
Unclassified	1 003 786	1.6	20.95
Total . . .	61 803 866	100	

The geographical distribution of the cattle other than milch cows i April, 1910 was as follows:

North Atlantic States		2 130 000
South » »		3 029 000
North Central »	west of the Mississipi . . .	12 320 000
» » »	east » » . . .	4 990 000
Southern and Gulf »		10 786 000
Far Western »		7 925 000
	Total . . .	41 180 000

The North Central States and the region including Oklahoma and Texas contain the largest number of cattle, the so-called "corn belt" States -- Ohio, Indiana, Illinois, Iowa, Missouri, Nebraska and Kansas -- accounting for almost one-third of the total number. Moreover, as large numbers of cattle are yearly brought into the "corn belt" to fatten, it is estimated that half the total beef produced in the United States comes from that district. As two-thirds of the cattle are west of the Mississipi, while two-thirds of the population are east of the Mississipi, there is an enormous movement of fat cattle from west to east to supply the demand for beef in the more densely populated districts, and this movement has brought about the establishment of the great cattle markets at Chicago, St. Louis, Kansas City, etc. These large central markets slaughter about half the total cattle in the United States. In 1903 the distribution of slaughtered cattle was estimated as follows:

	Head
At large central markets	6 570 000
In other cities of over 50 000 inhabitants . . .	930 000
In cities and villages of under 50 000 inhabitants	3 500 000
On farms and ranges	1 500 000
Total . . .	12 500 000

Further, in that same year, 520 000 head were exported alive, bringing the total number marketed for slaughter up to 13 020 000 head, of which 5 500 000 head or 45 per cent. were killed by six companies known as the "big packers".

AGRICULTURAL PRODUCTS: PRESERVING, PACKING, TRANSPORT. TRADE.

680 - **Arrangements for the Carriage of Agricultural Produce by Rail in France, especially on the Paris-Lyon-Méditerranée Co.'s System.** — BOUSIGUES in *Bulletin mensuel de l'Office des Renseignements agricoles*, Year 13, Nos. 2 and 3, pp. 194-212 and 300-329. Paris, February and March 1914.

The writer deals with the chief arrangements made by all the French railways for improving the carriage of agricultural produce. He describes the ice stores and the perfection of the rolling-stock on the State railway, the lowering of tariffs for milk by the Est Co., the fitting of vans for mushrooms, beer, bananas, beets and pulp on the Nord, and the various arrangements made by the Paris-Lyon-Méditerranée to encourage the trade in fruit, early vegetables and flowers. The last-named will be dealt with here.

From the agricultural point of view, the P. L. M. system is particularly rich; the natural resources of the districts it serves ensure a heavy traffic at all seasons: cereals in Brie, Beauce, Limagne and Lower Burgundy; wines in Burgundy, Franche-Comté, Auvergne, Languedoc and Provence; store cattle in the Charolais and the Nivernais; early vegetables and olives in Provence; oranges and flowers on the Riviera; fruit and vegetables in parts of the valleys of the Saône, Rhône and Durance. The Company also deals with the produce from Algeria, Tunis and Morocco.

Table I shows the progressive increase in the food-products carried by slow goods trains.

TABLE I.

Carriage by slow goods trains on the P. L. M. (metric tons).

Goods	1912	1911	1910	Difference 1912-1910
Wine	2 629 000	2 366 000	2 655 000	— 26 000
Flour	1 023 000	1 085 000	964 000	+ 59 000
Cereals	2 335 000	1 727 000	1 525 000	+ 810 000
Fruit, vegetables, milk, etc.	950 000	955 000	921 000	+ 29 000
Hay, straw	677 000	568 000	543 000	+ 134 000

The P. L. M. Co. has made special efforts to increase the traffic in fruit, early vegetables and flowers by express train ; for this purpose trains have been speeded up and the best possible conditions arranged. Table II shows the amounts of these goods carried by express service.

Besides the ordinary post-trains, the Co. runs eight or ten special trains for perishable goods daily ; their average speed is 40 m. p. h., so that the run from Marseilles to Paris (536 miles) is done in 22 to 24 hours and that from Avignon to Paris (458 miles) in 18 to 20 hours ; these times include unavoidable stoppages as well as the collecting at the various departure stations.

In 1911 this organization was completed by special arrangements at Chasse, a Station 13 miles south of Lyons on the left bank of the Rhône.

Arrangements at Chasse station. — The station is on the Paris-Ventimiglia line, and is the junction for three branches: Lyons-Nîmes by the right bank of the Rhône ; Roanne-Lyons, via St. Etienne; Paray-le-Monial-Givors. Goods can be sent to Paris and England by three routes: St. Etienne-Lozanne or Dijon ; to the Est Ry. via Dijon Is-sur-Tille ; to Germany via Bourg-Besançon - Belfort ; to Switzerland via Ambérieu-Geneva.

The vans passing through Chasse number 60 000 yearly ; the packages are rearranged so as to make up whole trains requiring no shunting other than the dividing up at junctions ; in this way 6000 vans are liberated. The Chasse station is informed by telegraph of the composition of the trains arriving, and has a practised staff who put right irregularities in packing and examine the labelling. The compensation for loss, delay and damage paid on the Paris markets, has been reduced to 156 000 fr., or 1.51 fr. (about 1*s* 3*d*) per ton.

The P. L. M. Co. has also arranged with the Nord and Est Cos. and the German State railways for through fast services ; these allow perishable goods to arrive in excellent condition on the markets in London, Berlin, Cologne, Frankfort-on-Main, etc. The times are as follows :

Avignon to London	37 hours
Avignon to Frankfort-on-Main	39 »
Avignon to Berlin (Anhalt sta.)	57 »

TABLE II.

Fruit and vegetables carried by express train on the P. L. M. *(metric tons)* (1).

	1912	1911	1910	Difference 1912-1910 %
Fruit.				
Table grapes	37 562	32 597	34 394	+ 9
Cherries	14 293	11 717	9 271	+ 54
Strawberries	6 551	5 993	6 552	—
Peaches	5 708	11 752	4 334	+ 32
Apricots	4 802	2 113	2 509	+ 91
Plums	4 255	2 195	2 731	+ 56
Pears	3 886	4 518	3 079	+ 26
Other fruit	12 568	9 631	9 844	+ 28
Total fruit traffic	89 625	80 516	72 714	+ 23
Principal destinations:				
France — Paris	29 500	30 300	29 400	+ 0.3
France — Lyons	4 400	3 800	3 900	+ 13
France — Saint Etienne	2 200	2 500	2 400	— 8
France — Other companies	8 300	8 100	7 000	+ 19
Abroad — Germany	14 300	8 000	6 900	+ 107
Abroad — England	5 200	4 200	4 000	+ 30
Abroad — Switzerland	7 700	6 800	4 800	+ 60
Abroad — Other countries (Belgium, Austria, etc.)	400	400	900	— 56
Algerian contribution to traffic on the system:	9 500	7 200	7 900	+ 20
including grapes	8 600	7 000	7 700	+ 12
Vegetables.				
Cabbages	23 132	17 299	12 944	+ 79
French beans	19 949	20 877	14 553	+ 31
Salad	18 662	16 183	16 806	+ 11
Artichokes	13 934	10 588	11 419	+ 22
Tomatoes	13 363	15 012	13 639	— 2
Melons	11 571	9 657	7 070	+ 64
Asparagus	8 710	9 646	8 331	+ 5
Green peas	6 127	5 205	7 575	— 19
Other vegetables	24 493	26 255	23 296	+ 5
Total vegetable traffic	139 041	130 722	115 633	+ 20
Principal destinations:				
France — Paris	29 000	30 800	28 700	+ 1
France — Lyons	10 300	12 500	7 600	+ 35
France — Saint-Etienne	6 400	7 600	4 700	+ 36
France — Other companies	19 300	18 100	12 000	+ 61
Abroad — Germany	14 300	6 900	8 000	+ 79
Abroad — England	1 300	600	800	+ 62
Abroad — Switzerland	12 700	11 300	9 900	+ 28
Abroad — Other countries (Belgium, Austria, etc.)	1 300	1 600	1 200	+ 8
Algerian contribution	6 600	8 200	9 100	— 27

(1) 1 metric ton = 0.9842 long ton.

The Company has 2847 fast vans (type H. P.) ; these are well ventil ated; the walls and roof are double, with an air-jacket, so that deli cate goods keep well.

The Company has sent commercial agents to study packing and outlet for produce on the spot. It has got into direct communication with foreign purchasers and the French producers. It has published notices on ex porting and distributed them free. At the Marseilles and other exhibi tions it arranged packing competitions ; it also defrays the expenses of exhi bits of the " United P. L. M. Producers ": these took 82 prizes a Turin in 1911. In Paris, in 1913, it arranged an exhibit covering 700 sq yds. and containing 5 000 dozen flowers from the Riviera. Educationa journeys to London, Scotland, Belgium and Holland have been arranged for producers.

On the Paris market the Company keeps an inspector to settle small dif ferences on the spot ; he also considers proposals for improving the service

In 1909 it distributed in the Carpentras district thousands of plants of a strawberry much in favour in Germany ; in 1911 and 1912 Mirabelle plum trees and greengage trees were distributed, as well as plum grafts. Grafts of very late table grapes were also distributed, and in 1912 and 1913 tomato seeds from Naples. It has experts to advise as to planting, and arranges lectures, field demonstrations and agricultural journeys in France and abroad. Further a series entitled " Publications of the P. L. M. Co. " has been printed.

Lastly, freights have been lowered on its own system, as well as for through carriage to other systems and foreign railways. In this connec tion a prize of 100 fr. (£ 4) has been aranged for prunes leaving France by the Nord and Ouest Cos.

Flower trade. — The principal lines for flowers from the Riviera are:

Paris.
England via Boulogne.
Germany via Petite Croix.
Belgium, Holland and Germany via Jeumont-Herbestal.

Almost all the Riviera flowers are sent in postal packages of 5 kg. (11 lbs.); they are packed in flat reed baskets, which are stacked in ordinary vans.

Table III shows the extent of the traffic in the last ten years.

TABLE III. — *Flowers carried by the P. L. M. (metric tons).*

Winters	Paris	England	Germany via Petit-Croix and via Paris	Geneva and Switzerland	Beyond Paris, various	Total
1903–1904	2 692	2 381	1 126	115	814	7 128
1904–1905	2 037	1 813	1 061	134	1 152	6 197
1905–1906	2 648	2 311	1 953	173	656	7 741
1906–1907	2 504	1 808	1 825	190	714	7 041
1907–1908	2 757	2 168	2 629	171	731	8 456
1908–1909	3 401	2 171	2 982	181	1 194	9 929
1909–1910	3 338	1 872	3 272	196	1 096	9 768
1910–1911	3 568	2 256	3 504	211	1 260	10 799
1911–1912	3 686	2 110	3 156	198	1 217	10 367
1912–1913 (1)	3 836	2 547	3 620	232	1 348	11 583

(1) From October 1912 to end of March 1913.

A collecting train arriving at Marseilles at 6.30 p.m. brings in the vans from the various stations, the most distant having started at 11 a. m. They are forwarded to Paris by two regular fast trains, one of which runs in two parts from November 15 to May I.

Flowers leaving Nice at 1 p. m. arrive:

Paris, next day at 10.30 a.m. (= 21 ½ hrs.) in the early season, or 8 a.m. (= 19 hrs.) in the height of the season.
Boulogne, next day at 6.30 p.m. (= 29 ½ hrs).
London, second day at 4 a.m. (= 39 hrs.).
Brussels, second day at 5 a.m. (= 40 hrs.).
Frankfort-on-Main, next day at 11 p.m. (= 33 hrs.).
Cologne, second day at 7 a.m. (= 41 hrs.).
Berlin, second day at 8 a.m. (= 42 hrs.).

Although the route from the Riviera to Berlin through France is 180 miles longer than the one through Italy (Chiasso-Bale), the time is the same and the French route costs less.

PLANT DISEASES.

GENERAL INFORMATION.

LEGISLATIVE AND ADMINISTRATIVE MEASURES

681 – **Decree of the President of the French Republic, April 18, 1914, relating to the Importation into Algeria of Plants other than Vines and Resin-yielding Trees** (1). — *Journal officiel de la République Française*, Year 46, No. 113, p. 3798. Paris, April 26, 1914.

Art. 1. — Woody plants (other than vines and resin-yielding trees), palms (rooted or not), and the fresh parts of these plants, coming from foreign countries and from the French departments of Alpes-Maritimes, Var, Bouches-du-Rhône, Gard, Hérault, Aude, Pyrénées Orientales and Corsica, may only be taken into Algeria through the ports to be designated by the Governor General of Algeria, or at the points on the Algero-Tunisian frontier to be determined by agreement between the Beylical Government and the Governor-General of Algeria.

On arrival at the ports or the points on the land-frontier, these products will be disinfected in buildings prepared for the purpose and under the direction of technical experts chosen by the Governor-General. Such disinfection will be carried out by means of a mixture containing gaseous hydrocyanic acid, the strength of which will be determined by the said technical agents.

The operation will be carried out at the expense of the interested parties. Exceptionally, when the consignments are accompanied by a phytopathological certificate granted by the Service of Phytopathological Inspection and are sent from establishments under State control, they will be exempted from disinfection, provided their freedom from all parasites is ascertained by the technical agents mentioned.

In case they are not passed, the importer may decide whether they are to be disinfected under the conditions laid down above or returned to their place of origin.

Art. 2. — Citrus fruits imported into Algeria will be disinfected under the conditions laid down in art. 1 for woody plants.

(1) See also No. 2026, *B.* June 1911 and No. 1347, *B.* Sept. 1912. (*Ed.*).

Art. 3. — Infringements of the regulations of the present decree and of the orders made for carrying it out will be punished by a fine of 50 to 500 fr. (£2 to £20).

Art. 4. — Persons convicted of having introduced any of the objects mentioned in arts. 1 and 2 without declaration or by means of a false declaration or by any other fraudulent device, will be punished by imprisonment for from 1 month to 15 months and by a fine of from 50 to 500 fr.

Art. 5. — The punishments laid down in the two preceding articles will be doubled for a second offence. A second offence is established when a first judgment under this decree has been given against the offender in the previous twelve months.

Art. 6. — Article 463 of the Penal Code is applicable to convictions under the present decree.

Art. 7. — Woody and herbaceous plants coming from France will be admitted into Algeria, with the earth surrounding them, provided they have been raised in pots at establishments listed by the Ministry of Agriculture under article 9, § 6, of the International Convention of Berne. For plants coming from foreign countries, this condition will be replaced by the obligation, on the part of the interested parties, to obtain a permit, supplied by the Governor-General of Algeria previous to the despatching of the goods, and after seeing a special declaration signed by the French consular authority of the place of origin.

All the regulations of the decree of March 10, 1894, not contrary to the present decree, are maintained.

Art. 8. — The decrees of January 25 and November 22, 1909, are abrogated.

Art. 9. — The Minister for the Interior, the Minister of Finance and the Minister of Agriculture are entrusted, within their respective spheres, with the carrying out of the present decree, which will be published in the *Journal Officiel* of the French Republic and inserted in the *Bulletin Officiel* of the Government of Algeria.

61 — **Act allotting 500 000 Francs to the Minister of Agriculture of France for the Control of Voles** (1). — *Journal Officiel de la République Française*, Year 46, No. 116, p. 3854. Paris, April 29, 1914.

The President of the French Republic has promulgated an Act, dated April 23, 1914, of which the following is the purport :

Sole clause. — A sum amounting to 500 000 francs is granted, from the 1914 budget, in addition to the provisional grants allocated by the Acts of December 29, 1913 and February 26, 1914. The sum will be inserted in a special article of the Ministry of Agriculture, bearing the No. 27 *bis*, and entitled " Grants to Communes, Syndicates and Agricultural Associations for the Destruction of Voles. Expenses of Organization of Control Measures ". The present Act, discussed and passed by the Senate and by the Chamber of Deputies, will be in force as the law of the Land.

(1) See also No. 385, *B.* April 1914. (*Ed.*).

DISEASES NOT DUE TO PARASITES AND OF UNKNOWN ORIGIN.

683 – **Leaf-Curl in Potatoes and its Connection with Necrosis of the Phloem.** — SCHANDER, R. and TIESENHAUSEN, M. in *Mitteilungen des Kaiser Wilhelms Instituts für Landwirtschaft in Bromberg*, Vol. IV, Part 2, pp. 115-124. Berlin, 1914.

The writers wished to control the investigations of Quanjer (1913), which led him to believe that leaf-curl of potatoes (Blattrollkrankheit) was due to necrosis of the phloem. Among the material examined was some of the same as was used by Quanjer.

It was ascertained that : 1) Necrosis may appear in plants not affected by leaf-curl (either in quite sound plants or in plants attacked by " Kräuselkrankheit ", etc.), and sometimes in a much worse form than in those affected by leaf-curl.

2) Such necrosis usually begins towards the apex of the stem, no doubt owing to the fact that the young tissues are more sensitive to assimilatory disturbances than the old ones. Further, it is more prevalent towards autumn in nearly all plants.

3) The phloem of the potato seems to be specially susceptible to this alteration, while in the tomato, which often suffers from strong leaf-curl, no important necrosis of the phloem has been observed. Thus, the phloem of the potato seems so susceptible that it may become necrosed without the plant appearing abnormal or losing its vigour.

4) General necrosis seems to be infrequent : the disease is generally limited to a portion of the phloem, so that complete interruption of the descending sap is very rare.

5) Lignification of the necrosed phloem has never been observed.

The writers believe this condition to be a secondary one, appearing in consequence of functional disturbances taking place in the leaves.

684 – **Observations on Bramble-leaf of Vines in Hungary** (1). — BERNATSKY, J. in *Zeitschrift für Pflanzenkrankheiten*, Vol. XXIV, Part 3, pp. 129-139, figs. 1–2. Stuttgart, 1914.

From observations in the vine districts of Hungary, the writer has ascertained the following facts with regard to the bramble-leaf disease (Krautern des Weinstockes).

1. It attacks old American stocks only on low ground, particularly depressions and valley-bottoms, on damp, rich and heavy soil. A rise of a few feet may quite prevent the appearance of the disease in such cases.

2. Young vines, one or two years old, may be attacked in situations favourable as regards height and soil.

(1) For previous work on this disease see the following Nos.: 1911—501 (Feb.), 1883 (June); 1912— 572 (March), 968 and 969 (June), 1097 (July), 1349 and 1350 (Sept.), 1570 (Nov.); 1913—67 (Jan.), 1207 (Oct.), 1302 and 1303 (Nov.), 1394 (Dec.); 1914—289 (March), 480 (May), 576 (June). (*Ed.*).

3. In many rather old vines examined (hybrids of Ripestris, Ruparia and Berlandieri) it was found that the swollen part at the top was dead; the dead tissue generally extended from the pith to the origin of the shoots. Further, there are streaks of brown wood reaching a good way down the stem, as often happens after frost damage.

4. The wood and bark of diseased vines, whether living or dead, is very incompletely differentiated, or in other words does not ripen off well.

5. It is interesting to note that diseased plants often come from grafts of poorly ripened wood; this is often the case in quite young vines in favourable situations, but yet diseased. For this reason, the writer considers the practice of using the ends or side shoots of the canes for grafts as unsound, for these parts are nearly always badly ripened.

6. The roots of vines affected by bramble-leaf were diseased, and sometimes even rotten. The writer considers this not as a result, but as the cause of the disease, and due to certain soil conditions.

7. In grafted vines (Vinifera on American stocks) the cause of the diseased condition is often to be found in an imperfect binding; this is particularly liable to occur with woody grafts on unrooted stocks. In good warm soils, with other conditions favourable, a complete closing of the tissues takes place later, but if the weather is unfavourable or the soil unsuitable (cool and damp), the wound tends to open wider instead of closing. Eventually it forms a cankerous growth, and the wood at the point of union is soft and hypertrophied, and finally dies. This disturbance of the relations between graft and stock shows itself later in the production of the bramble-leaf condition.

8. Even when the binding is perfect, the disease may appear. It is suggested that this may be due to damaging of the graft (*e. g.* by frost).

9. In grafted vines affected by the disease, the stock often throws out suckers, which also become diseased.

10. In making herbaceous grafts, the suckers are often not removed till the vine is planted out; they then leave open wounds, which may, under unfavourable conditions, spread and become cankerous, thus encouraging disease in the plant.

11. Parasites have sometimes been found to cause the disease, but only when present on the roots; of these cockchafer grubs (*Melolontha vulgaris*) are the most important, though *Phylloxera* may sometimes provoke it.

It thus appears that the cause of bramble-leaf is to be sought in conditions which act only indirectly on the canes, the trouble being deep-seated or the result of causes which have disturbed the whole plant.

BACTERIAL AND FUNGOID DISEASES.

GENERALITIES

685 – **On the Presence of Sori and Mycelium of Rusts in the Caryopses of Cereals.** — ERIKSSON, JACOB in *Comptes rendus hebdomadaires des Séances de l'Académie des Sciences*, 1914, 1st Half-year, Vol. 158, No. 17 (April 27, 1914), pp. 1194-1196. Paris, 1914.

Referring to Beauverie's observations (1) on the presence of the sori and mycelium of rusts in the caryopses of cereals and other Gramineæ, the writer remarks that he had already described and figured this in 1896; in 1901 he expressed the opinion that the presence of the sori and mycelium is to be considered as an abnormal and excessive growth, without practical importance in the life of the fungus. After the publication by F. J. Pritchard of similar observations in the United States, Eriksson made known in 1912 his own results on the wintering of cereal rusts. Results obtained since have confirmed the opinion that the presence of mycelium and clusters of spores on the surface of the caryopses is without importance.

RESISTANT PLANTS

686 – **Resistance of Hybrid Direct-Bearer Vines to Mildew.** — PÉE-LABY, E. in *La Vie agricole et rurale*, Year 3, No. 22, pp. 603-605. Paris, 1914.

One of the most important properties of hybrid direct-bearers is their resistance to mildew (*Plasmopara viticola*). The following among the older hybrids have been thoroughly tested in this respect in various parts of France: Seibel Nos. 1, 2, 63, 110, 138, 1000, 1007, 1014, 1015, 1070, 1077, 2003, 2007 and 2041; Couderc Nos. 503, 4401, 7103, 7120, 28-112 and 106-48. All these can do without copper-sulphate spraying in moderate mildew years. The following should under ordinary circumstances be sprayed twice: Seibel Nos. 47, 60, 128, 1020, 1200, 2042 and 2044.

Various newer hybrids appear to require only two sprayings, but have not yet been sufficiently tested; many of these yield better wines than the older ones, so that it is to be hoped that their mildew resistance will be confirmed. The following white hybrids may be recommended: Girerd No. 157; Seibel Nos. 880 (which might do without spraying), 793, 850, 2791, 3010, 3021 and 4681; several Malègue types, several Couderc and two Bertylle-Seyve.

Two new rose-coloured direct-bearers (Seibel Nos. 2859 and 2677) also appear to be sufficiently protected by two sprayings.

BACTERIAL AND FUNGOID DISEASES OF VARIOUS CROPS

687 – **Wilt Disease of Sweet Potato.** — HARTER, L. L. and FIELD, ETHEL C. in *Zeitschrift für Pflanzenkrankheiten*, Vol. XXIV, Part 4, pp. 204-207. Stuttgart, 1914.

The wilt disease of sweet potatoes is characterized by the wilting of the whole plant or parts of it; the diseased portions become discoloured and die; no wrinkling of the leaves takes place in such cases. The agent or agents of the disease occur in the vascular bundles of roots, stem and leaves.

(1) See No. 879, *B.* July 1913 and No. 73, *B* Jan. 1914. (*Ed.*).

Nectria Ipomoeae Hals. has generally been considered the cause of the disease, but a series of inoculations (1500) with various species of *Fusarium* isolated from the xylem of roots and stems and from tubers wholly or partly decayed, have shown that *F. hyperoxysporum* Wr. (isolated from the xylem of the stem) and *F. Batatatis* Wr. (from the vascular bundles of the root) are both parasites capable of producing the symptoms of wilt disease.

Inoculations of *Ipomoea Batatas* Poir. with *F. hyperoxysporum* produced 78 per cent. of infections, while with *F. Batatatis* 45 per cent. became diseased. The cultures of the latter were obtained from various parts of the United States (Maryland, New Jersey, Virginia and Delaware).

Inoculations with both species of *Fusarium* were tried on other plants : *Solanum tuberosum* L., *S. Melongena*, *Lycopersicum esculentum* Mill., *Ipomoea purpurea* Roth., *I. hederacea* Jacq., *I. coccinea* L., and *I. lacunosa* L. Only with *I. hederacea*, which grows wild in sweet-potato fields, were positive results obtained ; both species gave infection. It is probable that the disease is spread by means of this weed.

Inoculations with *Nectria Ipomœae* were entirely without result, so that this fungus appears not to be the cause of the disease. It appears that various species of *Fusarium*, in particular *F. oxysporum* Schlecht., *F. culmorum* W. Smith, *F. orthoceras* App. et Wr. and *F. caudatum* Wr., bring about the rotting of stored sweet potatoes.

688 – **Black Spots on Tomatoes caused by *Cladosporium herbarum*.** — PEROTTI, R. and CRISTOFOLETTI, U. in *Le Stazioni sperimentali agrarie italiane*, Vol. XLVII, Part 3, pp. 169-216, figs. 1-9, plates IX-XI. Modena, 1914.

Tomatoes of a variety with fruits in clusters have frequently been observed late in the season with olive-black spots on them ; these are nearly circular, and gradually increase in size : they are due to *Cladosporium herbarum*.

On naturally-occurring spots a bacterium has always been found with the *Cladosporium:* this is described as new under the name of *Pseudomonas polychromigena*. An undescribed form of *Oospora* (*Oidium*) *lactis*, var. *Solani*, is also frequently present.

The writers have investigated the morphology, physiology and pathogenic character of the *Cladosporium* and the *Pseudomonas*, as well as the relation of the *Oospora* and the *Pseudomonas* to the *Cladosporium* in the attack on the fruits.

The *Pseudomonas* is in no way parasitic, its development being permitted by the reduction of the acidity of the sap due to the attack of *Cladosporium*.

The *Oospora* is a true parasite of the tomato fruit, but takes no direct part in the formation of the spots. The *Pseudomonas* and the *Oospora* both tend to hinder the development of the *Cladosporium*, restricting and reducing the rapidity of its attack on the fruit.

The *Cladosporium* seems to infect the fruit through small breaks in the skin.

The proportion of fruits attacked in the variety in question is between 5 and 10 per cent. At present the disease does not seem serious, but

should it become so, the best course to pursue would be to grow varieties resisting it.

689 – **The Anatomical and Physiological Conditions of Chestnut Branches attacked by the Ink Disease.** — PETRI, L. in *Rendiconti della Reale Accademia dei Lincei, Classe di Scienze fisiche, matematiche e naturali*, Vol. XXIII, Series 5, 1st Half-year, No. 5, pp. 363-369. Rome, 1914.

The writer has already expressed the opinion that *Coryneum modonium* Griff. et Maubl. (which he considers identical with *C. perniciosum* Briosi et Farneti) should be regarded as one of the agents in the rapid withering of the branches of chestnuts attacked by ink disease (a black rot of the roots and the stool), and not as a cause of the disease.

In 1913 investigations were made on the physiological condition of the twigs in trees attacked by the disease.

Branches three to nine years old were collected from diseased and healthy trees in the chestnut-woods of Soriano nel Cimino (Latium) at the end of November 1913, when the trees had just lost their leaves. Various differences were found, chiefly by micro- and macrochemical means, between the branches from healthy and from diseased trees. The decreased content of certain minerals, such as lime, sulphur and potash, and the increased content of magnesia, are evidences of a diseased condition, due no doubt to disturbances in the functioning of the root-system. It is in the mineral food that the earliest and most serious irregularity takes place. The destruction of chlorophyll and the disorganization of the chloroplasts in the cortical parenchyma should be considered as the natural consequences of assimilatory disturbances and reduced vitality of the protoplasm, closely connected with the high acidity, absence or reduction of calcium oxalate, and increase of gallic acid.

These conditions no doubt allow the twigs to be attacked by weak parasites some time before any diseased condition is visible.

INSECT PESTS.

GENERALITIES

690 – **Insects injurious to Crops in the Nyasaland Protectorate.** — BALLARD, E. in *Bulletin of Entomological Research*, Vol. IV, Part 4, pp. 347-351. London, 1914.

The following insects have been collected on or bred from cultivated plants in 1911 to 1913 ; unless otherwise stated they are from the Upper Shiré district.

ORTHOPTERA. — *Acridiidae*. — *Maura bolivari* Kirby and *Chrotogonus* sp. are very destructive to seedling tobacco. The following also damage tobacco to some extent : *Acrida turrita* L. (Lower Shiré), *Zonocerus elegans* Thunb., *Catantops opulentus* Karsch, *C. solitarius* Karsch, *C. vittipes* Sauss., *C. melanostictus* Schaum, *Morphacris fasciatus* Thunb., *Oedaleus citrinus* Sauss., *Gastrimargus marmoratus* Thunb., *G. wahlbergi* Stål, *Acrotylus patruelis* H. S., *Oxyrrhepes procera* Burm. and *Acridium lineatum* Stål.

Gryllidae. — *Brachytrypes membranaceus* sometimes damages cotton by eating the roots.

LEPIDOPTERA. — *Noctuidae.* — The red bollworm (*Diparopsis castanea* Hmp.) is very injurious to cotton throughout the Protectorate; *Chloridea obsoleta* F. occurs everywhere with it, and besides destroying the bolls and flowers of cotton, attacks maize, tobacco capsules and chick-peas. *Earias insulana* is not as bad a pest of cotton as the previous two, possibly owing to its being severely parasitized by an Ichneumonid: it is generally distributed throughout the Protectorate and has been found on *Hibiscus*. *Euxoa segetum* Schiff. gnaws the stems of tobacco in January and February. *Prodenia litura* F. is worst in the tobacco seed-beds, but it also damages tobacco after planting out, and has been found on cotton and maize, and even once on tea. The larvae of *Plusia orichalcea* F., *P. chalcites*, *Cosmophila erosa* H. B., *Gonitis sabulifera* Guén. and *Acontia graellsii* Feisth. are more or less injurious to cotton, eating the leaves up to the time of flowering; on the Upper Shiré they are about from December to the middle of March. *Busseola fusca* is one of the worst pests in the Protectorate, boring into the stalks of maize and millet. *Pteronycta fasciata* Hmp. (newly described) is uncommon, but would be very injurious if it were to increase in numbers, as the larva bores into cotton stems to pupate; the slightest wind is enough to break one of the bored stems, so that the plant then dies.

Limacodidae. — *Parasa vivida* Walk. occasionally appears on coffee, doing considerable damage.

Lymantriidae. — *Heteronygmia leucogyna* Hmp. is common on mahogany (*Khaya senegalensis*); plantations near Somba have been almost completely defoliated by it.

Pyralidae. — The cotton leaf-rolling caterpillar (*Sylepta derogata* F.) is rare on cotton in the Upper Shiré, at any rate about Somba; further north, on the banks of Lake Nyasa, it is much more frequent and injurious. The larvae are largely parasitized by a Chalcidid.

Tineidae. — *Phthorimaea heliopa* Lower bores into the stems of young tobacco plants, and is most injurious in the seed-beds. *Gracilaria* (sp. nov.) is common, but not much to be feared; the larvae mine cotton leaves, but seem to have little effect on vigorous plants.

Nymphalidae. — *Hypolimnas misippus* L. was once found in a cotton-field, some plants being defoliated by considerable numbers of the larvae.

COLEOPTERA. — *Lagriidæ.* — *Lagria villosa* F. devours the flowers and leaves of pulse crops.

Galerucidæ. — *Ootheca mutabilis* Sahl. occurs on cotton, Leguminosæ and Cucurbitaceæ, being especially destructive to the flowers of native melons. *Diacantha conifera* Fairm. attacks Cucurbitaceæ and Leguminosæ. The imago of *Asbecesta cyanipennis* Har. eats the leaves of Leguminosæ, but is not very harmful. *Pachytoma gigantea* was found damaging the leaders of young cypresses in plantations at Mlanje, on the top of Mount Somba.

Tenebrionidæ. — *Zophosis* sp. (adult) is sometimes injurious to cotton and tobacco, while *Gonocephalum simplex* F. does a little damage in tobacco plantations.

Dermestidæ. — *Dermestes vulpinus* F. is common in houses.

Meloidæ. — *Mylabris tricolor* Gerst., *M. amplectans* Gerst., *M. dicincita* Bert. and *Decatoma catenata* Gerst. destroy cotton flowers, while *Ceroctis trifurca* Gerst. eats the flowers of soy benas and velvet beans (*Mucuna pruriens* var. *edulis*).

Curculionidæ. — Tha larvæ of *Apion armipes* Wagn. bore into cotton stems ; a swelling is produced at the injured part, and the stem may break in a strong wind ; the insect is capable of doing considerable damage and appears to be generally common in the Upper Shiré. *Calandra oryzæ* is very injurious to stored maize and rice. A species of *Isaniris* is common ; the adult eats cotton leaves, but does not do much harm.

Coccinellidæ. — *Epilachna dregei* Muls., *E. hirta* Thunb. and *E. paykulli* Muls. are harmful in gardens. *Chilomenes lunata* F. is very useful in destroying *Aphis gossypii*.

Cassididæ. — *Cassida gibbipennis* is somewhat injurious to Leguminosæ.

Nitidulidæ. — *Epuraea* sp. eats the stamens of cotton flowers, but is of little importance.

Ptinidæ. — *Lasioderma serricorne* F. tunnels into cigars and cigarettes.

HYMENOPTERA. — *Tenthredinidæ.* — *Athalia* sp. is very injurious to turnips and cabbages.

RHYNCOTA. — *Aphididæ.* — The cotton aphis (*Aphis gossypii* Glover) is very harmul in some seasons, especially those with heavy rainfall. *A. brassicæ* L. is abundant on cabbages and difficult to destroy with washes owing to its waxy covering. Another species damages beans. *Ceratophis lataniæ* Newst. has occurred on *Raphia vinifera* in the Botanic Garden at Somba.

Coccidæ. — *Pulvinaria jacksoni* Newst. has been noted in small numbers on cotton.

Coreidæ. — *Anoplocnemis curvipes* F. does some damage to cotton by sucking the sap ; it has also been observed puncturing young shoots of mahogany.

Pentatomidæ. — *Antestia variegata* Thunb. damages coffee berries, while *Atelocera stictica* Westw. sucks the young shoots of mahogany.

Pyrrhocoridæ. — The cotton stainer (*Dysdercus nigrofasciatus* Stål.) occurs throughout the Protectorate and is very injurious ; *Odontopus confusus* Dist. has the same habits, but is restricted to the lower and hotter parts.

691 – **Contribution to the Biology of *Bibio hortulanus*, and its Control.** – MOLZ, E. and PIETSCH, W. in *Zeitschrift für wissenschaftliche Insektenbiologie*, Vol. X, 1914, Parts 3 and 4, pp. 98-105 and 121-125. Berlin-Schöneberg, 1914.

Bibio hortulanus appeared in the Province of Saxony (Prussia) in quite epidemic form in 1913 ; previously it had only been known to injure beets, but in this season it attacked spring crops of barley and wheat so severely that many fields had to be ploughed up and resown.

The damage is due to the larvae, which go on feeding up till the beginning of May, when they pupate at 2 to 4 in. below the surface of the soil.

The writers have carried out a long series of laboratory experiments with chemicals and other means for the destruction of the larvae, as well as observations on the life-history with a view to finding a point of attack. Steeping of the seed gave no results, and contact poisons (sulphate of iron, soft soap) had very little effect on the larvae.

The following measures seem to give good results :

1) In cases of severe damage in spring, the land should be ploughed deeply at the time of pupation (which begins in early May) and then well rolled ; in this way a large number of the insects are prevented from reaching the surface, while those which do so will be much weakened. If it is necessary to plough earlier in preparation for another crop (say the middle of April), thorough harrowing should follow, so as to injure the larvae ; in this case little damage is likely to be done to the second crop, though a number of insects will emerge.

2) The best means of destroying the adults is to place wisps of straw on sticks about a yard high, in the places where the larvae have been noticed, at the time of emergence of the gnats : this begins about the 20th of May, only isolated individuals being observed as early as the 10th. The gnats settle by preference on these wisps, and can be collected and killed on cool mornings : several hundred may be found on a single wisp.

3) Care should be taken that no dung, particularly stable dung, is lying about at the time of emergence of the gnats ; farmers believe that the insects are spread by means of stable dung.

The abundance of these gnats in the Saxon province is very likely connected with the prevalence of beet aphids (*Aphis papaveris*) in 1911 and 1912, as the honeydew produced by them is very attractive to the gnats.

MEANS OF PREVENTION AND CONTROL

692 – ***Anagrus ovijentatus*, a Hymenopterous Parasite of the Eggs of *Lygus pratensis*.** (1) — CROSBY, C. R. and LEONARD, M. D. in *The Canadian Entomologist*, Vol. XLVI, No. 5, pp. 181-182, figs. 19-20. London, 1914.

From an egg of *Lygus pratensis* on *Erigeron ramosus*, obtained at Ithaca (New York) in October 1913, a Hymenopterous parasite was reared ; others were also obtained by enclosing heads of the plant in breeding-cages. It appears to be a new species, and is described under the name of *Anagrus ovijentatus* ; it is near *A. saga* Girault, but differs from this in several particulars.

693 – **A Nematode Parasite of the Olive Weevil *(Rhynchites ruber)*.** — DEL GUERCIO, G. in *Redia, Giornale di Entomologia*, Vol. IX, Part. 2, pp. 233-234. Florence, 1914.

The great irregularity in the appearance of the olive weevil (*Rhynchites ruber* Fairm,) (2) and in the amount of damage it does is very likely due in part to the presence of a so far unrecorded parasite : this is a minute Nematode worm, apparently a *Rhabditis*, which the writer has noticed since 1911. The worms attack the larvae when they leave the olives and burrow into

(1) See also No. 1381, *B.* Sept. 1912. (*Ed.*).
(2) See No. 1240, *B.* Aug. 1912. (*Ed.*).

the ground. Once inside the larva, the worm grows and reproduces, so that the host becomes a centre of infection for other larvae. The infected larva eventually becomes motionless and dies. After death the body becomes covered with a whitish felt, consisting of numbers of the Nematodes ; they are very prolific, so that the number hatching from the eggs is enormous.

694 – **Control of the Second Generation of Vine Moths by means of Protecting Envelopes.** — MILANI, A. in *Zeitschrift für Pflanzenkrankheiten*, Vol. XXIV, Part 3, pp. 139-148. Stuttgart, 1914.

The writer has made trials of the protecting envelopes (German patent No. 250 053, July 1, 1911) for use against the second generation of the vine moths (*Conchylis ambiguella* and *Polychrosis botrana*) ; these were carried out in the three seasons 1911-1913, in conjunction with the Vine-growing College at Geisenheim (Germany). The envelopes in question are conical and open below, and the opening is gummed ; they are put over the flower clusters in June, and the moths coming to lay are caught by the gum.

It has been found that grapes so protected were hardly damaged at all, while the unprotected ones were sometimes severely damaged.

INSECTS INJURIOUS TO VARIOUS CROPS

695 – ***Lachnodius greeni*, a New Scale injurious to Coffee in Madagascar.** — VAYSSIÈRE, P. — *Bulletin de la Société entomologique de France*, 1914, No. 5, pp. 156-157. Paris, 1914. — *Journal d'Agriculture tropicale*, Year 14, No. 154, p. 125. Paris, 1914.

The writer describes under the name of *Lachnodius greeni* a new scale-insect sent to the Paris Entomological Station by M. Fauchère, inspector of colonial agriculture in Madagascar. This species occurs in clusters on the roots and stems of coffee, covered over by cells of earth and bark made by ants. It appears to be a serious pest of *Coffea robusta* and *C. liberica*.

Treatment should if possible be carried out before the scales are covered up by the ants. The bottom of the stem and the parts of the roots attacked should be laid bare and then washed with a petroleum insecticide strong enough to destroy the insects without damaging the plants. Proper attention to the plants will also help them to resist the scale and other enemies.

696 – **The Yellow-headed Coffee Borer *(Dirphya princeps)* in Uganda.** — GOWDEY, C. C. in *Bulletin of Entomological Research*, Vol. IV, Part 4, pp. 279-281, 2 figs. London, 1914.

Dirphya (*Nitocris*) *princeps* Jord. (Cerambicidae) was first recognized in Uganda as injurious to *Coffea robusta* in 1910 ; it has since been found on *C. arabica* also.

The bushes attacked can readily be recognized by the accumulations of excreta and gnawed wood below them. The branch through which the larva has made its way into the main stem can generally also be recognized either by the openings of the horizomtal tunnels in it or by its tip having turned black : the latter occurrence is, however, not to be relied upon.

If the larva is still in the side branch, the simplest way to destroy it is to cut off the branch and burn it. If it has gone into the main stem the best thing is to inject a few drops of carbon disulphide or carbon tetrachloride into the gallery ; the side branch through which it has entered should

be cut off close to the stem, so that the opening can be used for the injection; this and all other openings should then be closed with damp clay.

If the larvae are not killed, the tree soon dies or else gets broken by the wind. Coffee bushes less than two years old do not seem to be attacked.

697 – ***Pseudococcus filamentosus*, a Scale injurious to Tropical Trees.** — VAYSSIÈRE, P. in *Journal d'Agriculture tropicale*, Year 14, No. 154, pp. 109-111. Paris, 1914.

Pseudococcus filamentosus Ckll. (=*Dactylopius perniciosus*) was first recorded about twenty years ago in Hawaii ; it has since spread to various parts of the world.

In 1899 it occurred in Mauritius on Euphorbiaceae and citrus fruits ; later it was reported from Jamaica. In 1906 it was found in Cairo on cotton and *Albizzia Lebbek*, and by 1909 it had become a serious pest of the *Albizzia* trees along the avenues of the city. In 1912 the writer recorded it in French West Africa (Koulikoro, Upper Senegal-Niger) on *Ximenia americana*. In 1913, German East Africa was stated to be the original home of this scale ; it was observed there on native cotton in 1909, and in 1911 was found to be highly injurious to ornamental trees in Daressalam.

A tree infested by this insect has its branches and leaves covered by masses of white filamentous waxy matter, which sometimes form sheets joining one branch to another. Among these masses can be found adult females, eggs and larvae. The recently-hatched larvae migrate in quantities to the young branches and leaves ; thence they are easily carried by the wind, birds or insects to considerable distances.

Severely attacked tres may be killed in a few months. Infection almost always begins at the top ; first the leaves turn brown and fall off, then the branches also wither and die. Hundreds of trees were killed in this way in Cairo, and also in Honolulu at the time of the outbreak in Hawaii (1891).

Till lately the number of host-plants known was limited, but at Daressalam it has attacked a great variety of trees. The most favoured are the following : *Albizzia Lebbek, Pongamia glabra, Pithecolobium Saman, Eriodendron anfractuosum, Citrus, Acacia arabica* and *Loranthus ;* the latter, being a parasite of various trees, tends to weaken them and make them more susceptible to the scale. At the same time, the *Terminalia* trees at Daressalam, though parasitized by species of *Loranthus*, were hardly attacked.

Other trees resistant to this scale are : the species of *Eucalyptus, Pandanus, Plumeria, Bauhinia* and *Bougainvillea*, as well as *Pithecolobium dulce, Syzygium guineense, Barringtonia racemosa, Anacardium occidentale*, various species of *Sterculia*, etc. Occasional hosts are : *Sapindus Saponaria, Chrysophyllum Cainito, Landolphia* sp., various species of *Ficus* and *Bambusa, Khaya senegalensis*, cottons, palms, *Melia Azedarach*, various species of *Agave* and *Albizzia, Ximenia americana*, etc. *Mangifera indica*, which was badly attacked at Daressalam in 1912, should also be classed here.

Among natural enemies so far know should be mentioned two Chalcidids (Hymenoptera), as internal parasites in Egypt, a predatory Hemerobid

larva (Neuroptera) in Cairo, and three Coccinellids: *Exochomus nigromaculatus*, *Scymnus includens* and *Cryptolaemus montrouzieri*. The last named ladybird, coming from the Cape, was found very efficient against this scale in Hawaii, and should be acclimatized in various parts of Africa to keep scales in check.

In new centres of infection cultural methods and insecticides should be given preference over introduction of natural enemies. In particular resistant species of trees should be chosen for parks and avenues, and infested trees of no economic value should be destroyed; *Loranthus* should also be removed. The best insecticide seems to be petroleum emulsion (6 to 15 per cent.) applied as a winter wash; mixtures of petroleum, soap and lime are also good.

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FIRST PART.

ORIGINAL ARTICLES

Agricultural Education in the Netherlands

by

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HIGHER AGRICULTURAL EDUCATION.

The seat of higher agricultural education is the National College of Agriculture, Horticulture and Forestry at Wageningen. Previous to 1906 this college was connected with the National Agricultural School at Groningen, the National Horticultural School and the Municipal College, all four being under the management of the same board. Since its separation from these other institutions the Wageningen College has undergone considerable development both as regards attendance and equipment. Teaching is now conducted on academical lines ; the courses are open to all, but only students who have been through the secondary schools (modern or classical) are admitted to the examinations. It already possesses good laboratories, a library, buildings for feeding experiments, etc., about 100 acres of land and a special hothouse for tropical plants. The following institutions are attached to the College : 1. Phytopathological Institute, which is also the headquarters of the Government Service for the protection of plants. 2. The Institute for Agricultural Machinery and Construction. 3. The Institute for the Sugar Industry, which undertakes more especially the training of young men for the East Indian sugar plantations. 4. The recently founded Plant Breeding Institute.

The staff of the College consists of 28 lecturers and a number of assistants. Instruction is given in all branches of agriculture, horticulture and forestry, both Dutch and tropical. At present 247 students are in attendance; of these, 34 have specialised in Dutch agriculture, 39 in tropical agriculture, 6 in horticulture, 5 in Dutch forestry and 44 in tropical forestry. The remaining 119 students are still following the preliminary unspecialised courses.

2. Secondary Agricultural Education.

The secondary agricultural schools comprise the National Agricultural School at Groningen and the Colonial School at Deventer. In 1896 a so-called "Indian class" was founded at the National Agricultural School to deal with tropical farming. In the colonial school the course lasts three years, at the Groningen school two and a half years. Both schools are well equipped as regards qualified masters for teaching natural science, agriculture and other technical subjects. (For curriculum, etc., see Tables I and II in appendix).

3. Special Schools and Special Courses.

(a) *National Dairy School at Bolsward.* — The course at this school extends over two years and is intended specially for managers of butter and cheese factories. Besides practical cheese and butter making the principles of commerce, book keeping and commercial correspondence in French, German and English are taught. Only students who have had at least eighteen months' practical work in a butter or cheese factory are admitted, and they must undertake to work in a dairy during their vacation, producing a certificate to that effect at the end of the vacation. Forty students were in attendance in the year 1912-1913.

(b) *Agricultural and Horticultural Winter Schools.* — The course at these schools lasts over two winter terms. There are at present in the Netherlands 9 agricultural and 5 horticultural winter schools, which are on the whole very well attended and much appreciated by the country people. They are especially adapted for lads whose presence at home is indispensable during the summer or whose means do not allow them to attend a secondary agricultural school. In order to be admitted, it is sufficient to have passed through the elementary schools, though the winter schools are also frequented by lads who have had a rather better education. The instruction given is purely theoretical, like that given in the National Agricultural College and in the secondary agricultural schools, and it is adapted to the special agricultural conditions of the districts in which the schools are situated. In the horticultural schools some facility for practical work is afforded by the school gardens. In the year 1912 the agricultural and horticultural schools were attended by 349 and 155 pupils respectively.

The directors of these schools are usually specially qualified in agriculture or horticulture and have under them one or two permanent teachers and some temporary elementary school teachers. Further details of the curriculum are given in Tables III and IV. Only pupils over 16 years of age are admitted, for in the Netherlands, as in other places, experience has shown that the older pupils profit most by the instruction. It is very desirable that the lads should attend continuation classes in the interval between leaving the elementary schools and joining the winter schools. Such classes exist in the country, but hitherto too little has been done for their development.

The fees at the winter schools are low, at most 16*s* per term, while books etc. amount to about £2 per head. As most of the pupils live in the immediate neighbourhood of the schools their total expenses are very moderate. If the pupil cannot afford it, the payment of the fees is not insisted upon and in such cases the books are also frequently supplied free of charge by the school. Scholarships are available besides, and allowances are made by associations and by the local authorities.

All winter schools are national institutions; this year, however, the Catholic Association for Agricultural Education will open a private winter school which will also receive a State grant. There is further a school of horticulture, which is not a winter school proper but resembles it in character. It was founded by the Frederiksoord Beneficent Association with funds given by General van Swieten.

(c) *Winter courses in agriculture and horticulture.* — This form of education is especially intended for those young farmers and gardeners whose presence at home cannot be dispensed with for any length of time even in winter. The courses generally extend over two winters and include from 300 to 400 hours of instruction. The lecturers are elementary school teachers who have undergone special training in agriculture and horticulture.

The courses in agriculture and horticulture are organised privately by associations and occasionally by local authorities, but they are subventioned by the State, which generally pays the lecturers and provides the material. Such courses are in great request throughout the country, and their number is constantly increasing. Unfortunately suitable lecturers are often wanting, but it is hoped that their numbers will soon increase, as special provision is being made for their training. In the year 1912-13 a total of 405 courses on agriculture and 119 courses on horticulture was held, with an attendance of 6015 and 2203 pupils respectively.

(d) *Agricultural and horticultural courses for adults and special courses.* — These courses, as a rule, consist of twelve lectures lasting two hours each. The lecturers are usually teachers with much practical experience. In the winter 1912-1913, 131 agricultural courses and 78 horticultural courses were held and they were attended by 3729 and 1567 students respectively.

Special courses are given in poultry keeping, horse shoeing, and live stock management.

(e) *Agricultural instruction for soldiers.* — On request of the military authorities, instruction in agriculture has been given to the soldiers of some garrisons since 1905. This is especially intended for those men who have been brought up in the country. A whole course consists as a rule of 12 lectures of two hours each on questions connected with manuring and live stock management. The lectures are generally well attended. In the winter of 1912-1913 these courses were held in 16 localities and attended by 565 soldiers.

(f) *Agricultural education for women.* — During the last few years, a start has also been made with regard to instructing the female rural population. In this respect the Netherlands are perhaps behind several other countries.

Formerly when butter and cheese were made in almost every farmhouse, special courses were held in these subjects. At present except in a few districts in South Holland and in the province of Utrecht, butter and cheese are made exclusively in factories, and dairy courses are only held in the limited districts mentioned above. In districts with light sandy soils, where small holdings are very numerous, special courses on livestock management, feeding, etc., are held for women. Of still greater importance, however, are the courses on domestic subjects, such as cooking, housework, first aid, gardening. In general the tendency is to get women teachers for the purely domestic subjects and special agricultural or horticultural teachers and medical men for the others.

Hitherto domestic economy has only been taught in short courses. Only one permanent school exists in the country, that at Lierop, which was opened in 1911 ; it is chiefly a cookery school for peasant women conducted by Catholic sisters. This year a new National School of Domestic Economy will be opened; for the present, only teachers of domestic economy will be trained in it. The courses on domestic economy are usually organized by agricultural associations who have special grants from the Government. In the year 1912, 53 courses were held, and attended by 1100 women students. In some places courses have been held for the wives of agricultural labourers; they have awakened much interest and will be continued.

With regard to the amounts of money granted by the Government for agricultural education, it should be noted that out of the total population of 5 411 800 inhabitants, about 2 683 800 live in the towns and 2 728 000 in the country. In the budget for 1913 the following sums were voted :

For the National College of Agriculture, Horticulture and Forestry.	£	22 875
For the two Secondary Agricultural Schools	»	7 464
For the National Butter and Cheese-making School	»	1 136
For the Agricultural and Horticultural Winter Schools	»	9 183
For other courses	»	16 333

Besides the Government grants, contributions to agricultural education are also made by associations and local authorities, but as these vary greatly no reliable data can be given.

Appendix.

TABLE I. — *Curriculum of the Secondary Agricultural School at Groningen.*

	Number of hours per week				
	Class I		Class II		Class III
	Winter term	Summer term	Winter term	Summer term	Winter term
Natural Science: Chemistry, Technology, Physics, Botany, Zoology and Mineralogy	13	11	7	6	4
History, Geography, Mathematics	8	5	1	1	3
Languages: Dutch, German, French, English	9	7	4	4	3
Economics	—	—	1	1	1
Agriculture	2	9	19	20	21
Total	32	32	32	32	32

TABLE II. — *Curriculum of the Secondary Colonial School at Deventer.*

	Number of hours per week		
	Class I	Class II	Class III
Natural Science: Physics, Chemistry, Zoology, Botany	10	9	12 ½
Mathematics, Surveying, Drawing	7	8	4
Languages (1): Dutch, German, English, French, Javanese, Sunda and Malay	8	5 ½	6
Tropical Agriculture: General, Special crops, Live stock management, Book keeping	11	15 ½	15 ½
Gymnastics, First aid	2	2	1
Total	38	40	39
Practical work included in the above time table	8	10	8

(1) German, French, Javanese and Sunda are optional subjects.

TABLE III. — *Curriculum at the Groningen Winter School.*

	Number of hours per week	
	Class I	Class II
Natural Science:		
Chemistry, Physics Botany, Zoology	12	7
Dutch, Arithmetic, Surveying, Mechanics	6	4
Agriculture:		
Soil and Plants	4–6	6
Animal husbandry and allied subjects.	10	12
Farming and Book keeping.	—	3
Total . . .	32–34	32

TABLE IV. — *Curriculum of Horticultural Winter School at Boskoop.*

	Number of hours per week		
	Class I	Class II	Class III
Natural Science:			
Botany, Plant Diseases, Physics and Chemistry . .	8 3/4	5	13 3/4
Horticulture:			
Plant breeding, Growing of ornamental trees, Fruit growing, Landscape gardening	6 1/4	10 3/4	17
Commercial subjects:			
Correspondence, German and English, Arithmetic, Commercial Geography, Book-keeping:	6	5 1/4	11 1/4
Total . . .	21	21	42

The Present Position of the Science of Manuring in Germany

by

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The discussion of this question is made easier by the publication of the symposium on " New Methods and Aims in Manuring ", in the March and April numbers of *Mitteilungen der D. L. G.* for this year. In this article the leading experts express their views, and consideration of these papers

leads to the regrettable conviction that we have not yet been able to solve the weightiest problem of the science of manuring, namely how to find out, rapidly and surely, the manurial requirements of a given piece of land before a crop is put into it.

Yet there is no doubt that we have got a good deal further in this direction in the last ten years, and for this we have especially to thank the efforts of KÖNIG (at Münster), MITSCHERLICH (at Königsberg) WAGNER (at Darmstadt) and PFEIFFER (at Breslau), who have done much to increase our knowledge of the analysis of soils and crops. It is true that water containing carbonic acid was known to the older agricultural chemists as a means of obtaining a soil extract suitable for analysis, but the finer type of experimental and critical observation work was not yet undertaken.

To Mitscherlich belongs the credit of having instituted researches regarding the temperature, concentration, and duration of influence of this agent, and of obtaining partially satisfactory results from them. He succeeded in finding out, with reference to the cultivation of spring sown cereals, a regular relation between the quantities found in the carbonic soil extract and those recovered in the harvested crop, although his experiments have not yet stood the test of independent investigation.

It will be interesting to see whether the methods suggested by König for determining the assimilable mineral plant foods of the soil prove reliable. König starts from the assumption, which has a good deal to be said for it, that the pioneer work of microorganisms, yeasts and catalases in bringing into solution the compounds of potash and phosphoric acid in the soil, is most readily investigated if the soil to be examined is previously steamed under pressure. For potash requirements, König believes in steaming for 5 hours under a pressure of 5 atmospheres : as a result of his latest experiments, he arrives at certain standards, as for example that soils of which the potash content rendered soluble by steaming only amounts to 5 mgms. per 100 gms. of soil, will benefit by a potash dressing, whereas if this figure reaches 8 mgms. the soil does not need potash ; in the same way a soil which after steaming, gives less than 4 mgms. of soluble phosphoric acid will profit by a dressing of phosphates. At the same time he does not wholly reject as an extracting agent the 2 per cent. citric acid solution recommended by GERLACH of Bromberg more than a decade ago. Unfortunately the indefatigable veteran experimenter has not hiherto, in the course of his comprehensive researches, been able to determine definite relations between the quantity of nitrogen and of lime taken up by plants and the absolute quantity of these substances existing in the soil. He is, however, of opinion that in this case the percentage content of the dry matter of plants provides a sufficient clue as to whether these substances are present in the soil in sufficient quantity.

Such an admission as this is a further stimulus toward plant analysis, the applicability of which has, in the last few years, been advocated by Wagner and Pfeiffer. Wagner's doctrine, according to which a meadow the more urgently needs manuring with the chief fertilizing agents, the more widely the content of its air-dried hay varies from the limit values " 2 per

cent. potash, 0.7 per cent. phosphoric acid, 1 per cent. lime", has already been many times confirmed, and steps are now being taken to establish similar standards for spring-sown cereals. In calculating an analysis of hay, the fact must be borne in mind that, as a rule (and my own investigations support this), the second cut is richer than the first in P_2O_5 and in CaO, as well as in protein, while on the other hand the potash content is lower. It may here be remarked that nitrogenous manuring for meadows and pastures has come more into fashion in Germany, in the last five years than could justifiably have been expected from the opinion hitherto prevailing on the subject.

Speaking generally, however, the pot and field experiments which Wagner has developed in so masterly a manner, continue to hold the first place in the determination of manurial requirements; Hiltner who also showed the possibility of applying potash and nitrogen to plants direct through the leaf-organs is now occupied in arranging water culture experiments with the same object.

Should the farmer not be in a position to make use of experiments, which, after all, only tell what happened on a given piece of land, he would do well to call to his assistance the so called "Soil Statics", and keep a soil account-book; though this might not be necessary for the whole farm or for the whole of the arable land, at any rate it would be of value for the individual "hungriest" fields. Soil Statics, that is, the science of balancing the intake and output of the plant foods in the soil in relation to its power of plant production, which was, before the introduction of artificial fertilizers, a much valued means of determining manurial requirements, has not achieved the success expected of it after the recent efforts to restore it to favour. All the same soil statics, as proved by my own comprehensive experiments, provide the critically minded arable farmer with a useful indicator, particularly as to whether a further application of potash and phosphoric acid is profitable; for fertizers like nitrogen and lime, which are easily modified or washed out of the soil, the method is less suitable. The subject is fully explained in Part 251 of *Arbeiten der D. L. G.*

A fact which is not without its significance in the practical application of statical calculations is the discovery, which has received repeated confirmation, that the ratio between the plant foods found in the composition of normal plants is something like 100 N : 50 P_2O_5 : 150 K_2O : 80 CaO, although many plants, the Leguminosae for example, show considerable divergences from these proportions. The farmer who reckons out his stock of the principle plant foods per acre for each piece of arable land on the basis of an up-to-date and complete soil analysis, and from this substracts the quantity of plant foods contained in the forthcoming crop at harvest (allowing about 1 per cent. for wastage) on the above ratio, will be able to measure approximately, before the annual crop sowing, the quantities of manure which he must still apply to his land. In doing this, however, he must take into consideration the average coefficients of utilization of the said plant foods and all the other factors which influence the productive

capacity of the soil. If he continues this calculation in the following years, he will, of course, not need a fresh soil analysis, the previous year's figures being used as a basis.

There exists at present no method at once rapid and entirely free from objection, of determining the manurial requirements — not the plant food requirements — of a soil, and there is not likely to be one until the biological and colloido-chemical actions taking place in the soil have been more clearly defined. The work of decomposition due to bacteria, the numerous sources of production of carbonic acid and the conditions affecting the coagulation of colloid substances which is important for growth, are matters too complex and varied, even on the smallest scale, to admit of being expressed in incontestable numerical terms, in the light of our present knowledge and with our present methods of investigation.

Apart from the revival of Statics, the Law of the Minimum has very recently formed the central point of numerous investigations. The endeavour to find a symbolical representation of this fundamental Law of Nature on the basis of Wollny's definition gave rise to a keen competition, as described in detail in my report on the prize competition on this subject in Part 245 of *Arbeiten der D. L. G.* In this connection it should be noted that Mitscherlich, on the proposal of P. Mazé, wants this law, which was already known to Karl Sprengel, to be designated "The Law of Physiological Relations", since the amount of plant-production depends on the collective effect of a number of growth factors, each of which individually exercises on that amount a retarding influence proportional to its own proximity to the minimum. This suggestion may contain a germ of truth, but at the same time the name "Law of the Mimimum", chosen by Liebig, will not so soon disappear from the vocabulary of practical scientists; and it may well be preserved for application in the case of plant foods, since these are factors over which man can exercise a vigorous control.

The present current of opinion in this sphere is strongly influenced by the fact that certain factors formerly regarded as bring present in excess, for example carbonic acid, are now suspected of being present only in the minimum quantity. Individual experiments with ornamental plants show that flowering in glass-houses is considerably improved by applications of carbon dioxide, made by means of a cylinder, or by the action of hydrochloric acid on marble, or by burning alcohol. Similar success was looked for with agricultural crops, from the application under the soil, of carbonic acid, either in the form of gas by means of pipes, or by means of rapidly decomposing organic substances. Unfortunately this success has hitherto been practically unattained, but all the same the problem, on which we possess a number of accurate studies by earlier investigators, will still be kept in view, just as for a considerable time the question of making a more productive use of the sun's energy, in combination with artificial watering and manuring, has been under discussion.

It is not without interest to recall, in this connection, that STRACKOSCH, of Vienna, who established the "Law of the Variation of Work done by Cultivated Plants", and who started the idea of the "Assimilative Effect"

(relation between the utilizable substances produced and the quantity of plant food consumed), succeeded in obtaining an increase of yield amounting to about 11 shillings an acre by altering the cropping scheme on his estate at Hohenau in accordance with this " Assimilative Effect "; these results he described in a lecture before the Royal and Imperial Agricultural Society in Vienna. (See *Österreich Agrar-Zeitung*, 1913, N° 18).

In this case " Energetics " may be said to play a part inasmuch as Strackosch avails himself, for the determination of the effective utilizable value, of Kellner's " Starch Equivalents " that is to say, of a conception based on " Energetics ", as Remy has already pointed out.

Even, however, if more arable land is eventually to be permanently cropped than is at present the case, the sun's energy will still remain no more than a powerful contributing factor in the development of private and national wealth. The quintessence of human art in agriculture lies, in my opinion, in the correct application of fertilizers to well prepared soil, and in sowing productive varieties.

As SCHULZE, of Breslau, has recently shown, the remains of the roots and stubble of grain and of root-crops do not by a long way leave in the soil the quantities of plant food required for the attainment of maximum harvests ; even if, in the case of Leguminosae, the whole of the aerial portion of the plants on a field were also applied as green manure, the utilization of them by the succeeding crop by means of bacterial and chemical processes, assisted by the return of plant foods from the body of the plants before they are ripe for harvest, would still, in the majority of cases, by no means come up to expectation. According to the pot experiments published by Professor VON SEELHORST in Part 241 of *Arbeiten der D. L. G.*, the losses by washing out of nitrogenous green manure are very considerable on light soils, so that the utilization during a three-course rotation may be taken at only about 30 per cent.

The same applies, in the long run, to the utilization of the nitrogen in farmyard manure, which can, however, be greatly improved by keeping the liquid and solid manure separate in the cowhouses ; the liquid manure should be kept from contact with the air in a tank with a lid, and should also be covered with a layer of petroleum or oil. Ortmann, who owns the manor of Schependorf, has been trying for some time to introduce a method of storage of this kind into general use in Germany, and such endeavours are worthy of support, for with nitrogenous manures at their present price, it makes a considerable difference whether one employs liquid manure containing 1 or 2 per thousand nitrogen or that containing 6 or 7 per thousand. Recent experiments have shewn that liquid manure treated in this manner produces excellent effects, equal to those of ammonia, but it must be thoroughly covered with earth, immediately after being applied, or at least be ploughed in shallow, as in the case of farmyard manure well soaked with urine (box or yard manure). If it can only be used as a top-dressing it is profitable to add crude sulphuric acid as a preservative.

A further series of experiments is now in progress in Germany, with the object of discovering within what limits home produced manures can

be replaced by commercial manures. The trials which have been carried on during the last 70 years on the home farm at Wingendorf near Freiberg, in Saxony, seem to show that this method of farming cannot be continued through several decades without fundamentally impairing the yield, except on good soils containing plenty of humus, and even then, only when the remains of the roots and stubble are allowed to accumulate for the enrichment of the soil.

The majority of the German farms carrying no live stock work principally with green manure or, in some parts, also with night-soil combined with heavy dressings of artificial fertilizers, while here and there manure is purchased from neighbouring towns, or straw is handed over to neighbouring farmers to be used for making manure and returned. Farms using only commercial fertilizers only exist in isolated cases, or this system is confined to the outlying portions of the farm. In any case, it has been found again and again that profitable root crops can, as a rule, only be obtained by an intelligent combination of home produced and commercial manures, while cereals following a previous crop dressed with farm-yard manure or green manure usually pay well for a complete dressing of artificial fertilizers suited to the previous crop and to the strenght of the soil. It is a universal rule in all the better managed farms, to keep the replacing of plant foods at a minimum, or, having regard to the kind of manure, crops, and soil, and to the rotation practised and the general circumstances of the farm, to approach the line of soil enrichment, taking into account the time occupied by the various farm crops in absorbing plant food.

Agricultural chemists in Germany are busily engaged in determining the utilization coefficients and the best adapted forms in which to apply both home-produced and commercial manures under the most widely varying conditions ; numerous articles have been published on the agricultural value of all these fertilizing materials, especially the different forms of phosphates, potash, and above all nitrogen, such as that contained in nitrate of soda, nitrate of lime, nitrate of potash, ammonia, and organic and cyanic nitrogen. Nitrogen is the plant food most often present in the minimum quantity, and unfortunately it is also the dearest. It is therefore not surprising that it is this element which is the subject of the most extensive study, a fact which is also manifested in the numerous applications for patents having for their object the utilization, for fertilizing purposes, of the nitrogen of the air. But technical science is also endeavouring to make use of crude phosphates, minerals containing potash, and the less pure limes, and to make them available to agriculture as fertilizing materials — with what success, Pfeiffer and Lemmermann have reported in this journal. (1)

Potash salts are at present being worked at more than 150 mines, and, like amber, represent up till now a natural monopoly of Germany. The fu-

(1) See " The Possibility of Using Crude Phosphates and Limes containing Silica as Manures ", by Prof. TH. PFEIFFER, *B.* Sept. 1913, pp. 1316-1321 ; also " The Possibility of Replacing Stassfurt Salts by Finely Ground Phonolite, Leucite, etc. ", by Prof. LEMMERMANN, *B.* Oct. 1913. pp. 1483-1495. (*Ed.*).

ture will shew whether this will continue to be the case, and whether the deposits discovered in recent years in the north of Spain and elsewhere give promise of profitable working. For the present, they can only be regarded as of historical interest, in the same way as the working of certain quartzrocks for platinum recently undertaken in Westphalia.

A special interest has become attached in the last few years to the three substances magnesia, silicic acid and sodium. Since Professor Willstätter ascertained that the colouring matter of chlorophyll contains about 4 per cent. of magnesia, but no iron, this base has received the attention it deserves, and this not only for the sake of proving Loewe's theory of the so-called " Lime Factor ". Similarly, sodium and silica, which have come into prominence on account of the discussions on phonolite and the researches into the chemistry of colloids, have become the subject of recent investigations ; Schulze, among others, has been able to prove a direct nutritive effect of sodium. It is true that the preparation named " Natramon ", an artificial product composed of 75 parts of sulphate of ammonia to 25 parts of common salt, has not been able to establish itself in practice but on the other hand an addition of rock salt to nitrogenous manures containing no sodium was accompanied by the most successful results especially for plants requiring sodium, *e. g.* mangels and beets, barley and certain vegetables. As regards silica, German agricultural chemists maintain their previous opinions.

It would take too long, here, to go into the experiments which have for their object the investigation of what are called catalytic fertilizers or stimulants, such as the salts of sulphur, manganese, boron, aluminium lithium, rubidium. As we cannot deal with questions having at present no practical significance, we must leave out of consideration the question of drilling in fertilizers and using the rotatory spreader, as opposed to the broadcasting method prevalent in this country, also the question of the applicability of powerful, high percentage preparations of urea, and the new composite manures, known as nitrate of ammonia and nitrate-phosphate and, in general, all the latest — and unfortunately also in most cases short-lived articles which appear on the manure market. The said market seems likely soon to be brought under Government control in Germany as already elsewhere.

It is certain that the great increase in the consumption of artificial fertilizers (see Table II, p. 984), and the corresponding increase in our crop yields (see Table I, p. 983), which represent an expenditure of some 600 million marks by the German farming industry, are due not to the superstitions of ministers nor to unsound or misleading theories, but to systematic and representative researches, clear sighted regulation of the means of communication, and distribution, on the widest scale and in the shortest time, of accurate reports of the results of experiments. In this work apart from the advertisement departments of the great manure manufacturing houses, the chambers of agriculture and agricultural societies (notably among them the German Agricultural Society) each have their meritorious part, as have also, in particular, the schools of agriculture with

their travelling instructors, the agricultural colleges, and, of course, the experiment stations. It should here be observed that it was also the German Agricultural Society which extended its researches from field, meadow and pasture, to orchard, vineyard, forest and lake. At the same time this Society afforded financial assistance for the training of young students in methods of research and exerted itself to bring to a satisfactory solution the interpretation of the results obtained from manurial experiments. Since the foundation of the Imperial Fund for Advertizing Potash, it has fortunately been also possible to introduce the employment of artificial fertilizers into the tropical agriculture of the German colonies in a clear-sighted and comprehensive manner, and even to establish there, for that purpose, trained agricultural chemists.

There is no doubt that, in spite of being heavily overburdened with the work of analytical control of agricultural goods, the representatives of German manurial science have made good use of their time, and that many gaps have been filled up in the sphere of knowledge entrusted to them within the last ten years through their accurate and methodical researches.

It is a matter for congratulation that the Government and other competent authorities recognize the activity and success of these experiment stations, and assist in promoting the development of all institutions of this kind. Another step to be hailed with satisfaction is that the experiment stations themselves are seeking to form separate departments for research and control — indeed many are going still further and resolving themselves into separately located and separately administered research stations and control stations. Finally, it is to be hoped that the State may gradually assume control of all experiment stations, just as in the same way the question should be considered of a uniformly regulated training for the rising generation of agricultural chemists. Then the far-reaching conceptions and the numerous details introduced in the above-mentioned symposium would more speedily attain a satisfactory solution, to the great benefit of agriculture and of political economy.

Appendix.

TABLE I. — *Average yields of the chief crops in Germany*, 1890-1912 (*lbs. per acre*).

	Rye	Wheat	Barley	Oats	Potatoes	Meadow hay
1890–91 — 1894–95	1 170	1 460	1 480	1 290	9 390	2 960
1895–96 — 1899–00	1 280	1 580	1 480	1 410	10 380	3 620
1900–01 — 1904–05	1 380	1 700	1 650	1 530	11 500	3 590
1905–06 — 1909–10	1 490	1 780	1 740	1 720	12 400	3 870
1911	1 590	1 850	1 780	1 590	9 230	(1) 2 910
1912	1 660	2 010	1 950	930	13 410	(1) 4 100

(1) Irrigated meadows : 1911 — 4 000 lbs.; 1912 — 4 940 lbs.

TABLE II. — *Consumption of commercial fertilizers in German agriculture*, 1890-1912.

	1890 — metric tons	1900 — metric tons	1910 — metric tons	1912 — metric tons	Value in million of Marks
1. Bone meal	99 001	63 462	81 063	75 500	c. 6 3/4
2. Guano (artificial and natural)	45 888	37 450	40 200	40 200	» 5 ½
3. Superphosphate (incl. misures)	500 000	754 944	1 267 060	1 640 600	» 98
4. Basic slag	400 000	878 917	1 428 633	1 800 000	» 81 ½
5. Nitrate of soda	247 815	352 785	542 137	630 250	» 130
6. Sulphate of ammonia	60 000	117 638	268 330	356 150	» 100
7. Various (cyanamide, nitrate of lime, dried blood, horn meal, etc.)	50 000	50 000	60 000	100 000	» 18
8. Potash salts (total)	219 553	833 472	2 219 037	2 700 000	» 71
(As crude potash salts)	—	(774 916)	(1 953 964)	(2 320 000)	—
Total (1)	1 622 257	3 088 669	5 906 530	7 352 700	c. 512

(1) Owing to lack of precise data, these figures are only approximate, except for potash

Lime may be estimated at 800 000 to 1 000 000 metric tons, worth 12 to 14 million Marks ; this sum may be set against the mixed manures (ammonia-super, etc.) included with superphosphate, so that the final total will not be materially altered.

The prices of the chief artificial manures have diminished considerably since 1870 ; this fall is to no small degree due to the competition of newer manures, such as sulphate of ammonia and basic slag. The wholesale prices have been about as follows :

	Unit of N in nitrate of soda	Unit of water-soluble P_2O_5 in superphosphate
	s	*s* *d*
1870	25	9 6
1890	15	6 6
1912	14	3 5

Potash salts and limes show no distinct change over the last decade but a slight rise has very recently set in. Kainit was at 18*s* a ton in 188 and down to 15*s* in 1900, while 40 per cent. potash salts have been sold a about £3 4*s* per ton since 1890. Since the Potash Law came into force (beginning of July 1910) the crude salts with 12 to 15 per cent. of K_2O have been sold at 1*s* per unit (carnallit with 9 to 11 per cent. only 10*d*), while the prepared salts with 40 to 42 per cent. K_2O have made 1*s* 6 ½*d* per unit

The Dairy Industry of Great Britain

by

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For the last twenty years the Dairy Industry in Great Britain has been steadily growing in importance, and dairy farming has to a large extent taken the place of other kinds of farming.

This may be accounted for by the increased consumption of milk by the populace, which has been and still is being educated to realise the high feeding value of milk, which has become more and more part of the national everyday diet of adults as well as children.

An estimate made some time ago put it that the annual increase in the consumption of milk amounted to some 5 000 000 gallons, but it is doubtful if such will continue the annual figure if the retail price of milk is unduly increased. But whilst people are learning more concerning the value of milk in their daily dietary, it is as yet difficult for the majority to realise that in proportion to its cost it is the cheapest food obtainable. Thus, whilst the price of most foods has gone up recently, that of milk also has been slightly increased. An increase in the price of milk, however, is generally resented by the public, which resentment is apt to show itself in the form of a decreased consumption. People would not, however, endeavour to effect economies in their living expenses by cutting down the quantity of milk purchased if they possessed a proper knowledge of the feeding value of this food in proportion to its cost. Undoubtedly no other food can be obtained in Great Britain at as cheap a rate, taking into consideration its food value.

Now of what value is the Dairy Industry of Great Britain at the present time? The answer is supplied in some figures recently published by the Statistical Department of the Board of Agriculture, by which it is shown that the estimated quantity of milk produced, after allowing for the amount used for calf-rearing, is 1 208 000 000 gallons per annum.

As to the manner in which this milk is dealt with, it is calculated that 70 per cent., or 850 000 000 gallons, is sold as milk, whilst the value of the dairy products respectively as sold by the farmers is :

£24 963 000	for	milk
£ 590 000	»	cream
£ 2 940 000	»	butter
and £ 1 400 000	»	cheese.

These figures show very clearly the great value to the farming industry of the milk sold for consumption in the towns, whilst the total sum realised for the milk and its products is about the same as that realised for the wheat, barley and oats grown. Furthermore it nearly reaches the sum obtained for cattle sold as meat.

It would be interesting and instructive to compare these figures with similar estimates for say two decades back, but unfortunately this cannot be done, such returns not being available. What has happened, however, in recent years is that dairy farming has steadily been taking the place of corn growing, and arable land has been turned into pasture to suit the altered class of farming, thus resulting in an ever decreasing area of cultivated arable land.

Where corn growing has not been found to pay, dairy farming has generally been substituted, and it has also largely taken the place of fattening cattle—a class of farming which has not been very remunerative of recent years, owing to the large importation of foreign and colonial meat that has come into operation.

Now whilst the importation of butter and cheese from abroad largely influences the value of these commodities as produced in Great Britain, there is practically no importation of milk to affect the value of the new milk trade. The populace of Great Britain, whilst existing and being dependent chiefly on foods imported from abroad, is fortunately able to obtain a supply of home-produced milk to meet its requirements fully. Small quantities of fresh milk are imported from countries within easy reach of the British Isles, but the quantity is negligible and the trade at present shows no prospect of developing.

Milk selling has been described recently as the sheet anchor of the English farmer, and certainly it has assisted him to an extraordinary extent when other systems of farming have failed. He realises that he is free from the competition created by imports from abroad that exists in the case of most other commodities, and thus is able to develop his trade without the fear of having to compete with others who can produce milk at cheaper cost. The retail price in towns varies from 1*s* 2*d* to 1*s* 4*d* per gallon. In many large towns up to within about four years ago milk was sold at 1*s* per gallon all the year round, but it is now generally sold at 1*s* in summer and 1*s* 4*d* in winter, making an average price of 1*s* 2*d*, though in many of the large towns it does not vary from all 1*s* 4*d* the year round and 1*s* 8*d* per gallon is charged for the best class trade in London.

Generally speaking the wholesale price of milk throughout the country may be taken as about 7½*d* per gallon net to the farmer throughout the year after the freight charges have been deducted. About 8 ½*d* net is obtained in the winter and about 6 ½*d* net in the six summer months. The cost of transport in the country generally may be taken as 1*d* per gallon which conveys the milk up to 100 miles. Comparatively little milk travels short distances so as to secure the ½*d* per gallon rate which conveys it for 20 miles.

It is not the same with the butter and cheese trade, however, for these have to compete with imports from very many parts of the globe. The imports of butter into Great Britain are valued at £24 000 000, and those of cheese at £7 000 000, which totals more than the whole amount realised for milk, cream, butter and cheese produced in the country. The cost of production in most countries from which butter and cheese

are received is much less, owing to cheaper land, cattle, feeding, etc ; hence the development of the milk trade in Great Britain at the expense of the manufacture of cheese and butter, as shown in the figures previously quoted.

The question arises as to what is being done to cope with the increased demand for milk and the possibility of the demand being greater than the supply. As previously mentioned, more and more arable land is being converted into pasture, which is the main requirement for dairy farming ; but apart from this must be considered the number of stock capable of being carried by the total amount of land available. Farming in Great Britain is still regarded as one of the less important industries, though there are many movements on foot at the present time to make it more productive and to increase the area of land available for agricultural purposes, by bringing under cultivation soil which at present is more or less unproductive. If, however, these points are left out of consideration and it is assumed that the present available land is carrying practically all the stock it is capable of doing, which we think is by no means the case, there is still a means of increasing milk production. This is by means of increasing the yielding capacity of the dairy cows, or, in other words, devoting special attention to breeding and selecting animals for high yields of milk. A great deal of work is now being done in this direction both by individual dairy farmers and public bodies—work that ten years ago merited but little attention. If the average yield per cow, as is estimated for Great Britain, is only some 350 to 400 gallons, then it follows that much improvement is possible. Milk records are being carried out by various County Councils and Dairy Associations (1) the results of which show the quantity and quality of the milk yielded annually by each individual cow in the herd, and this information enables the farmer to retain only the cows which give satisfactory results.

In Scotland a number of Dairy Societies have been started and have been in operation some five or six years, with the result that Milk Record Schemes of great value have been obtained and much growth in this is being continued. It is found that in most herds the variation in the annual yield per cow is great, for whilst the poorest animal may give 350 gallons or less the best may be yielding 1 000 or perhaps more. Now the cost of keeping and tending an animal yielding a large quantity of milk does not much exceed that of a poor cow ; hence if only good cows of tested capacity are kept, as much as 50 per cent. more milk may be obtained from a similar number of cows.

Most dairy farmers, even men who have been engaged in the work for many years, seldom know the milk yield of each cow in their herds, and milk records have shown as wide a difference between two herds on adjoining farms as 200 gallons per cow. Thus the farmer whose herd averages 600 gallons per cow per annum, may look forward by exercising care in selecting his cattle to increasing the yield to 800 in the course of a few years.

(1) See No. 1439, *B*, Oct. 1912. (*Ed.*).

Numerous dairy farmers, however, do not breed their own stock, but instead buy cows which they retain for one, two or three years and then sell them off fat to the butcher. The calves of such animals are usually also sold to the butcher, and this system of dairy farming tends to reduce the quantity of milking stock in the country and many of the best dairy cows are thus lost. Such may be considered a very extravagant method of dairy farming, and to the farmer in this case milk records do not appeal, as he does not keep his cows a sufficient length of time and does not retain any of the progeny, even of the best ones.

The favourite breed of Dairy cattle throughout the country is the Dairy Shorthorn — an animal of Shorthorn type but not of pedigree strain. A good animal of this class may be valued at from £18 to £25.

The factory system of dairying is not extensively carried on in Great Britain, but in Ireland there are a very large number of Creameries, and butter-making on Danish methods is practised. In England the large centres of population require the milk for consumption, but in Ireland there are but few large towns and their requirements of new milk are limited, allowing for an extensive manufacture of butter. Where factories exist in Great Britain they usually engage in all branches of the dairy industry, selling milk to the towns whenever possible and making cheese and butter. The former generally gives better returns than converting the milk into dairy products, hence the manufacturing periods are chiefly when milk is plentiful and the markets overloaded. Of course in many cases there are factories where cheese or butter is manufactured and milk selling not undertaken, but these are becoming fewer and exist chiefly in the more isolated districts. The greater part of the butter and cheese produced is still made on the farms, but even this is rapidly changing and where farmers formerly manufactured the milk at home they are commencing the sale of the milk.

A number of factories on co-operative lines are being established. Such factories, started and run by the farmers themselves, are proving a very satisfactory means of regulating the milk trade, as when there is a surplus of milk it need not be placed on the market and so lower prices, but can be converted into cheese and butter. Further, where the milk is manufactured at a factory it is possible to produce an article of more uniform quality than is the case at individual farms, and the smaller dairy farmers are thus enabled to obtain a better return for the milk produced on their holdings.

Whilst it is still a fact that the finest quality butter and cheese is produced at the best farms, it is nevertheless true that the bulk compares very unfavourably in quality with that turned out from the factory where skilled labour and scientific methods are in vogue. Much expenditure has been made in teaching butter and cheese-making for many years past, and doubtless some general improvement in farm-made dairy products has resulted, but on the whole the return has been small in proportion to the expenditure involved. It has indeed become generally recognised that it is better for a group of farmers to start a dairy together, properly equip it and employ the best skilled labour rather than continue the manu-

facture of dairy products at home. Better means of marketing are possible and generally better financial returns are the result.

For the protection of the public, various laws affecting the production and sale of milk have been put into operation recently and further restrictions on the sale of milk will come into force when what is known as Mr. Burns' Milk Bill at present before Parliament becomes law. Parliament, after many years of apathy, has become alive to the needs that the nation has of supplies of pure wholesome milk. It doubtless realises that the health of the nation depends greatly upon supplies of pure milk, especially as milk has now become so commonly used in the daily dietary of the great majority, and moreover it is the chief food of children who need most protection.

Following upon the reports of the Royal Commission on Tuberculosis, whose investigations and findings during the last twenty years have shown that tuberculosis or consumption in human beings is largely caused by tuberculous milk and meat, an order came into force on May 1st by which all tuberculous cattle must be notified. Such cattle are to be examined by Veterinary Inspectors appointed by the County Councils, and on their recommendation all obviously tuberculous animals and cows suffering from tuberculous udders will be slaughtered, compensation to the extent of one quarter of the estimated value of the animal being paid to the farmer where advanced tuberculosis is discovered. Where tuberculosis is manifest but not advanced three quarters of the value will be paid — in each case half the cost of the valuation and examination to be deducted.

This is an important move in protecting the public, especially children, from tuberculous milk and meat, as unfortunately a fairly large percentage of tuberculous milk is now marketed ; indeed some recent figures of extensive analyses made of London's milk supply showed no less than 10 per cent. of the supply as containing the tubercle bacilli. Municipal authorities can exercise powers to prevent the entrance of milk in towns from any source when it is proven to be tuberculous, but such powers are seldom used. Whilst the Tuberculosis Order will doubtless in a few years result in the killing off of most badly tuberculous cattle, there will still remain the animals that are apparently healthy but are really tuberculous as shown by the tuberculin test. In several instances private enterprise has embarked upon the supply of milk solely from cows which have passed the tuberculin test and are kept periodically tested, which is the only sure way of obtaining a milk supply guaranted free from tubercle germs.

This alone is not the only part of the scheme, as if milk is obtained pure from healthy cows it must not be allowed to get contaminated from human infection afterwards and before it reaches the consumer, and to prevent this it must be handled and distributed under proper hygienic conditions. There is a minimum Government standard of quality which specifies that if milk contains less than 3 per cent. of fat and 8.5 per cent. of solids-not-fat it is presumed, until the contrary is proved, that the milk is adulterated.

The law also prohibits the use of any chemical preservative whatever in milk, though harmless colouring matter is not debarred. Recently too the use of preservatives in cream has been restricted and it is now illegal to add any preservative whatever to cream containing less than 40 per cent.of fat. If cream containing over 40 per cent. fat is preserved, only borax, boric acid, and hydrogen peroxide are permitted to be used, and all receptacles in which such preserved cream is sold must have affixed to them a label printed in letters of a specified size varying with the size of the vessel, stating the preservative used, and if borax or boric acid or both be present, the percentage expressed in terms of boric acid must be stated on the labels. Restaurants and Refreshment Rooms serving preserved cream are required to display notices to this effect.

Appendix.

TABLE I. — *Number of churns of milk delivered daily at London railway stations by the various railway companies in* 1907.

	No.
Great Western Railway	3 999
London and South-Western Railway	2 477
London and North-Western Railway	1 670
Great Northern Railway	1 153
Midland Railway	1 094
Great Eastern Railway	952
London, Brighton & South Coast Railway	941
South-Eastern & Chatham Railway	377
Great Central Railway	175
North London Railway	122
Metropolitan Railway	50
West London Extension	16
Total	13 026 churns

or 13 026 × 17
= 221 442 gallons

Approximately therefore the amount of milk reaching London daily by rails is 221 442 gallons and the quantity brought to London by road or produced in London is small.

The North-Eastern Railway Company has kindly supplied the following figures for the imports of milk into Newcastle during 1911: estimated number of gallons 1 952 502. As this City has a population of 266 603 this means roughly 7.3 gallons per head, but it should be taken into consideration that the milk arriving by rail is by no means all the milk received in Newcastle, as a large number of farmers in the district convey to and retail milk in the City.

TABLE II. — *Quantity and value of cheese exported to each country from the United Kingdom in the year* 1912.

Countries to which consigned	British and Irish Produce		Foreign and Colonial Produce	
	Cwts	£	Cwts	£
Russia	149	704	*	—
Germany	604	2 785	905	3 235
France	475	2 137	1 255	4 662
Spain	134	595	*	—
Egypt	118	540	960	3 438
United States of America	592	5 291	141	420
Chile	186	864	*	—
Brazil	277	1 255	12 426	49 100
Netherlands	*	—	320	973
Belgium	*	—	2 359	8 363
Portugal	*	—	5 037	20 820
Italy	*	—	883	2 754
Philippine Islands and Guam	*	—	2 049	7 422
Cuba	*	—	204	673
Other foreign countries	1 061	5 286	3 547	12 802
Total to foreign countries	3 596	19 457	30 086	114 662
Channel Islands	322	1 216	2 988	9 720
Cape of Good Hope	334	1 511	13 017	40 152
Natal	146	710	5 983	18 231
British India	2 181	10 126	1 880	8 313
Australia	115	740	**	—
British West Indies	314	1 564	**	—
Gibraltar	**	—	2 053	7 321
Malta and Gozo	**	—	2 651	9 307
Transvaal	**	—	8 021	25 978
Other British Possesions	1 534	7 547	2 618	10 971
Total to British Possessions	4 946	23 324	39 211	130 513
Total	8 542	42 781	69 297	245 175

* Included (if any) in other foreign countries.
** Included (if any) in other British Possessions.

TABLE III. — *Quantity and value of butter and cheese imported into the United Kingdom from each country in the year* 1912.

Countries from which consigned	Butter		Cheese	
	Cwts.	£	Cwts.	£
Russia	683 650	5 656 742	*	—
Sweden	335 014	2 113 871	*	—
Norway	30 634	192 183	*	—
Denmark (inc. Faröe Islands)	1 618 048	10 356 001	*	—
Iceland and Greenland	3 973	21 264	*	—
Germany	2 355	12 221	*	—
Netherlands	113 716	641 638	268 286	701 696
France	246 652	1 559 452	16 030	56 852
Italy	1 534	8 560	91 060	306 287
United States of America	2 596	15 250	21 227	66 565
Argentine Republic	67 244	396 964	*	—
Belgium	*	—	442	1 429
Switzerland	*	—	12 226	41 200
Other foreign countries	119	657	1 579	4 478
Total from foreign countries	3 105 535	18 974 803	410 890	1 178 507
British India	924	3 559	**	—
Australia	549 396	3 225 886	1 408	4 903
New Zealand	349 012	2 148 192	543 917	1 882 840
Canada	27	145	1 452 570	4 347 832
Other British Possessions	265	1 608	2	9
Total from British Possessions	899 624	5 379 390	1 897 897	6 235 584
Total	4 005 159	24 354 193	2 308 787	7 414 091

* Included (if any) in other foreign countries.
** Included (if any) in other British Possessions.

SECOND PART.

ABSTRACTS

AGRICULTURAL INTELLIGENCE

GENERAL INFORMATION.

698 – **Legislation for the Protection of Moors in Germany.** — *Landwirtschaftliches Wochenblatt für Schleswig-Holstein, amtliches Organ der Landwirtschaftskammer*, Year 64, No. 18, pp. 405-406. Kiel, May 1, 1914.

LEGISLAT
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The law of March 4, 1913, for the protection of moors in the province of Hanover has been extended (April 1, 1914) to the provinces of Pomerania and Schleswig-Holstein.

The object of the law is to prevent the uneconomical exploitation of the moors. It prescribes that plots of land which alone or with others form a compact area of moor more than 25 ha. (62 acres) in extent, so far as public interest requires it, can only be worked for peat in such a way as to ensure their further profitable use for agriculture or forestry.

The use of such plots for cutting out of peat requires the authorization of the district committee, for which an application has to be made. Before granting the authorization a competent office to be nominated by the Minister of Agriculture, Domains and Forests has to be consulted, as well as the Improvements' officials. If requested, an expert named by the applicant has also to be heard. Against the decision of the district committee the applicant may appeal within two weeks to the Minister of Agriculture. Undertakings which had already begun cutting out peat before the law had come into force may continue to work for six months longer without being subject to the limitations of the new law.

The authorization to cut out peat is not required when the peat is used in the household or farm of the owner, farmer, or person entitled to excavate peat or of an agricultural labourer under permanent engagement to the owner of the peat bed, when his agreement authorises him to cut peat for his own household or farm. Further the authorization is not required when the peat is cut for sale, provided such cutting be conducted by not

more than six persons and without machinery. The district police, however, may issue regulations with regard to peat cutting in order to safeguard the interests of agriculture or forestry.

699 – **Experiments with Plots of Different Sizes** (1). — SCHNEIDEWIND, in *Mitteilungen der Deutschen Landwirtschafts-Gesellschaft*, Year 29, Part 21, pp. 298-300. Berlin, May 23, 1914.

Experiments have been undertaken at the experimental farm at Lauchstädt, with the object of comparing the yield from different sized and differently arranged plots, and the influence of manuring on the respective yields. The plots have been laid out on a very uniform piece of land, and the experiments, which are to be continued for a considerable time, are arranged as follows.

I. 30 plots of 9 sq. metres (10 $^3/_4$ sq. yds.) each, adjoining one another without intervals.

II. 20 plots of 9 sq. metres each, in the form of a square with an unplanted margin 80 cm. (31 in.) wide all round.

III. 18 plots of 100 sq. m. (120 sq. yds.) each adjoining one another, without intervals, and without any unplanted borders.

IV. 6 plots of 200 sq. m. (240 sq. yds.) each, but otherwise resembling Group III.

In 1913 sugar-beets were sown on the plots. One row of plots in each of the four groups received 1.6 cwt. and one row 3.2 cwt. of nitrate of soda per acre, while the third received no nitrogenous manure.

The returns are only complete for Groups I, II and IV. The yield of the plots with borders round them (Group II) was, in the "unmanured" cases, superior to that of Groups I and IV (without borders) by about 4 tons an acre of fresh roots.

The nitrogenous manure had less effect on the plots with borders, where more nitrogen and moisture were available for the plants on account of the free space, than on the other areas : while 3.2 cwt. of nitrate of soda per acre produced on the Group I plots an increase of about 2 tons of roots an acre, and on those of Group IV an increase of about 37 cwt., a similar dressing only gave an increase of 23 cwt. on the plots with borders. The results obtained from the 1.6 cwt. per acre dressing of nitrate of soda do not agree satisfactorily with the above.

700 – **The Work of the Buitenzorg Botanic Gardens for 1913.** — DE JONG, A. W. K. in *Mededeelingen van het agricultuurchemisch laboratorium*, No. VII, pp. 1-49. Batavia, 1914.

The experiments carried out at the Botanic Gardens in Buitenzorg during 1913 led to the following conclusions.

1. Earthnuts ploughed in green not only increase the following rice crop but also the next earthnut crop taken after the rice.

2. The largest increase with manioc was obtained when complete manures were used, but nitrogenous manures alone were almost as efficient.

(1) See No. 795, *B.* July 1913. (*Ed.*).

3. No increase was obtained in crops of sweet potato, lemon-grass and earthnut when dung was added to potassic fertilizers.

4. Earthnuts grown continuously on the same field appear to become more resistant; the number of dead plants gradually diminishes.

701 – **Formation of an Agricultural Office for Tripoli.** — *Bollettino di Informazioni dell'Ufficio Economico del Ministero delle Colonie*, Year II, No. 4, pp. 271-273. Rome, April 1914.

The Royal Decree of March, 1914, instituted an Agricultural Office in Tripoli for the purpose of carrying out experiments of a technical and economic nature in that country and to study the means of encouraging the native agriculture and colonisation. The office comprises:

a) an experimental section, technical and economic;

b) an administrative section;

c) a section including the meteorological, engineering, statistical and other departments necessary for the development of the Office.

The staff of the Office may be chosen from amongst Civil Servants or from private individuals possessing the required qualifications and will be made up as follows:

	No.
Director	1
Heads of the administrative and technical departments	2
Technical experts	4
Secretary	1
Laboratory assistants	4
Field men	4
Labourer	1
Porter	1

In accordance with the suggestion made by the Commission appointed to investigate the agricultural conditions of Tripoli, the Minister of the Colonies has decided to let experimentation precede demonstration and the giving of advice, with regard to both technical and economic questions. The first director to be appointed to the office is Prof. De Cillis, from the Royal Agricultural College at Portici, Naples, and he will also form part of the Government Commission for investigating the agricultural conditions of Tripoli.

702 – **Agricultural Shows.**

United States.

1914 Oct. 7-17. Wichita (Kansas). — International Soil-Products Exposition, held on the occasion of the Ninth International Dry-Farming Congress.

703 – **Agricultural Congresses.**

Italy.

1914 Sept. 24-29. Milan. — Third National Congress of Applied Chemistry. Dr. Vicentini, Via Marsala 8, Milan.

United States.

1914 Oct. 7-17. Wichita (Kansas). — Ninth International Dry-Farming Congress. Secretary: Ralph H. Faxon, Wichita, Kansas.

CROPS AND CULTIVATION.

SOIL PHYSICS, CHEMISTRY AND MICROBIOLOGY

704 – **Separation of Soil Particles according to their Specific Gravity, and the Relations between Plants and Soils.** — KÖNIG, J. (Report from the Agricultural Experiment Station at Münster-in-Westphalia), in *Landwirtschaftlicher Jahrbücher*, Vol. XLVI, Part 2, pp. 165-251. Berlin, 1914.

I. *Separation of Soil Particles according to their Specific Gravity.*

The writers have separated out the constituents of seven soils by means of liquids of different specific gravities; the liquid used was a mixture of bromoform and benzol, which may be considered as without action on soils. The separation was carried out at first by shaking followed by settling till the liquid was clear, the floating particles remaining at the surface and the remainder at the bottom; subsequently an improvement was made by centrifuging the liquid for 10 minutes instead of allowing it to stand. Altogether four of the mixed liquids were used, with S. G. 2.36, 2.49, 2.55 and 2.64, giving five soil fractions. Two of the soils (one clay and the other schistose) could not be separated by shaking and settling, in the case of the schistose soil owing to the constituents being practically uniform; it was also found that organic material adhered to the heavier particles and could not be separated even by continued shaking. With the help of the centrifuge the separation was better, and even the clay and schistose soils could be dealt with.

Physical and chemical examination of the five fractions led to the following general conclusions:

1. The facility or otherwise of the separation is an indication of the heterogeneity or homogeneity of the soil. The clay gave none of the two heaviest fractions (I and II) even on centrifuging, while the lightest (fraction V) amounted to only 1.08 per cent. Of other soils, those containing plenty of humus and colloids give considerable amounts of the lighter fractions, whilst preponderance of the heavier fractions indicates a soil lacking in humus and therefore of low fertility.

2. Fraction I (S. G. more than 2.64) is almost lacking in clays; in the sand, the loamy sand, the loam and the calcareous soil it does not exceed 1 per cent., while in the schistose soil it reaches 7.3 per cent. It consists largely of silicate fragments.

3. Fraction V (S. G. less than 2.36) contains large quantities of organic matter, as well as the bulk of the colloids and nutritive substances of use to plants.

4. It should be noted that fraction V (or in general the fractions containing most nutritive material) also contains the largest amount of silicic acid, iron oxide and alumina, *i.e.* colloids; the humus is so intimately connected with these minerals that it cannot be separated from them mechanically. This tends to support the view arrived at in previous work that the humus in the soil is present, at any rate in part, in the form of complex humate-silicates.

5. Comparison of the five fractions shows that in all four soils examined in detail (sandy garden soil, calcareous soil, loam and sand) there is an almost regular rise in the relative amount of nutritive material from I to V or at any rate from II to V.

8. The distribution of clay (*i.e.* the portion of the soil freed by sulphuric acid) in the different fractions varies with the type of soil.

II. *The Relations between Plants and Soils.*

Culture experiments have been in progress since 1904 in connection with the work on the investigation of the soil (1), especially with a view to determining the relation between the amount of dry matter produced and such properties of the soil as catalytic energy, nutritive material freed by oxidation, or by steaming under pressure, osmotic pressure, colloid content and oxidizing power. Six types of soil (sand, schistose soil, clay, loam, calcareous soil, and sandy loam) were used, and the experiments were made both in the open and in pots under glass.

During these investigations the following points were elucidated:

1. The plants grown in pots under glass generally gave higher yields for a given area than those growing in the open, but the difference in the experiments was not so great as in many conducted elsewhere.

2. In hot dry summers, the absorption of minerals, particularly phosphoric acid, may be much greater than in cool rainy ones, but this is not necessarily associated with increased production of dry matter. The increased absorption of phosphoric acid in hot dry weather is no doubt due to increased oxidation, and consequently increased solubilisation, of the phosphoric acid in organic combination, owing to increased penetration of air into the soil.

3. The relations between the principal nutritive elements absorbed and the dry matter produced are shown in the accompanying table:

Conditions of experiments		Parts of dry matter produced for 1 part of:					
		Nitrogen		Phosphoric acid		Potash	
		Limits	Average	Limits	Average	Limits	Average
10-year average for six soils	under glass	59–65	62	—	177	38–86	69
	in the open	57–62	59	137–176	161	36–57	48
In the very good garden soil		31–67	49	79–153	109	30–83	47
Previous experiments under various conditions		30–82	57	92–272	169	29–94	61

For lime, the ten-year averages gave figures ranging from 61 to 100, average 83. It appears that the following values may be used for determin-

(1) Published in *Landw. Versuchs-Stationen*, 1907 to 1913.

ing the necessity of manuring for any particular soil (using averages of the various crops) :

	Relative dry-matter value: Minimum below which manure is not required	Maximum above which manure is required
Nitrogen	50	62
Phosphoric acid	100	170
Potash	47	60

Individual crops show marked deviations, as shown by the following values for potash :

Cereals	73
Potatoes	38
Red clover	37
Mangels	29

For lime, red clover gives a value of 31, while the average of the other field crops is 126.

4. The general relations of the four nutritive materials to one another in the dry matter of plants are :

N	P_2O_5	K_2O	CaO
100 :	35 — 40 :	130 — 140 :	75 — 80

Here again there are deviations for individual crops, in particular Leguminosae ; thus the P_2O_5 per 100N is only 19 for red clover against 44 for the other crops and 56 for mangels.

5. The sum of potash + lime is fairly constant, being 3.0 to 3.5 per cent. of the total dry matter.

6. Unbalanced manuring with potash and phosphates, in soil not requiring these elements, and especially in time of drought, may reduce the amount of dry matter produced.

7. In all the soils except the sandy loam, very good correlation has been established between the amount of dry matter produced by the plants and the following chemical or physical properties of the soil :

a) amount of ammonia absorbed (Knop) ;

b) amount of potash and phosphates absorbed (M. Fesca) ;

c) hygroscopicity (A. Mitscherlich) ;

d) absorption figure for methyl-violet ;

e) osmotic absorption of water ;

f) electrolytic conductivity (the last three in the Münster investigations).

8. The best method for determining the amount of potash available for plants is steaming the soil for 5 hours under a pressure of 5 atmospheres. In the individual experiments as well as in the 10-year average the amount of soluble potash down to a depth of 6 to 8 in. determined in this way was very near the amount taken up by the plants.

It may be concluded that soils giving only 5 mgms. of potash soluble in this way per 100 gms. of soil require potash manuring, while soils

containing more than 8 mgms. do not require it. Here again, of course, individual crops vary, beets and clover taking more than the amount considered " available ".

9. The " available " phosphoric acid determined by various methods does not show any close agreement with the amount taken up by plants : it appears that the higher the content of the soil in lime, magnesia, iron oxide and alumina, the more difficult is the absorption of phosphoric acid. Weather and plant-species are also of importance. At the same time it may be said that soils giving less than 4 mgms. of phosphoric acid per 100 gms. of soil by the steaming method, require phosphatic dressings.

10. For nitrogen and lime no definite relation between the absolute quantity in the soil and the quantity absorbed by plants has been determined.

11. Application of either the electrolytic conductivity or the steaming under pressure method before and after the culture period is useful for determining the amount of nutritive material removed from the soil by the plant. In these experiments, the amount of phosphoric acid taken up ranged from 23 to 34 per cent. (average 29 per cent.) of that in a soluble condition after steaming.

705 – **Rocks and Soils in their Relation to the Nutrition of Plants.** — BLANCK, E. in *Die landwirtschaftlichen Versuchs-Stationen*, Vol. LXXXIV, Part V and VI, pp. 399-425. Berlin, 1914.

The writer has carried out vegetation experiments with eruptive rocks and crystalline schists having the following percentage composition:

	Quartzite schist	Porphyry	Granite		
			1	2	3
SiO_2	92.611	76.552	73.499	73.752	74.399
Al_2O_3	5.093	12.145	14.565	13.838	14.065
Fe_2O_3	0.520	1.720	3.086	3.566	2.166
CaO	0.287	0.893	1.733	1.866	1.267
MgO	0.607	0.673	0.386	0.720	0.833
K_2O	—	4.806	3.466	3.900	4.660
Na_2O	—	2.346	3.946	3.733	3.380
P_2O_5	traces	distinct traces	distinct traces	distinct traces	distinct traces
Loss on ignition	0.840	1.540	0.466	0.360	0.567
	99.938	100.675	101.147	101.735	101.337

The material used in the experiments consisted of unweathered rubble as it comes from the quarry. It was then crushed so that it resembled more or less fine-grained groats and in this form it was placed in the culture pots. As experiment plants, oats and peas were used. No manure was

given, except 0.1 gm. of ammonium sulphate for the oats. The peas received a solution of soil in which peas had grown, so as to inoculate the nodule bacteria. Thus the action of any artificial manure on the components of the rocks may be said to be practically non-existent.

The results of the experiments are summarized as follows by the writer :

1. The four igneous rocks examined, namely three granites and a porphyry, proved superior to the quartzite schist in the crop of oats and peas, but the plant food contained in the quartzite schist was much better utilized than that contained in the igneous rocks.

2. These experiments have demonstrated that mica-potash, especially biotite-potash, is much more accessible to plants than the potash of felspar.

3. Sandstones, according to previous experiments made by the writer, are much more suitable for the growth of plants, both for the amount of yield and for the utilization of the plant food, than quartzite schist, granite or porphyry.

706 – **A Further Case of Soil Sterility in the Dutch East Indies.** — Ledeboer, F. and Berkhout, A. E. in *Mededeelingen van het Proefstation voor de Java-Suikerindustrie*, Year XXII, No. 18, pp. 653-672. Surabaya, May 1914

Soil sterility due to the presence of excessive quantities of chlorides and sulphates is a well-known phenomenon in the Dutch East Indies ; such salts are probably derived from flooded craters ; but a case of sterility has recently been investigated from the Pemalang district which revealed the presence of large quantities of soda mostly in the form of carbonate ; the percentage being much higher than that given by O. Maior (1) for sodic soils at Sipote (Jassy). This large quantity of soda accounts for the curious character of the Java soil : when it rains the soda forms adsorption compounds with the soil colloids, thus producing hydrogels, then dries out very slowly, undergoing such a large decrease in volume that cracks appear at the surface.

Manurial experiments have already proved that the addition of 1.2 per cent. of quicklime produces a wonderful improvement, while the addition of 3.6 per cent. injures the vegetation but completely changes the structure of the soil, as the lime displaces the soda in the colloidal compounds and causes flocculation. Gypsum employed in similar cases in America and India gave even better results, as the sulphuric acid formed neutralizes the alkali which is injurious to plant roots.

Analyses of subsoil water revealed a content of 492 mgm. of sodium carbonate per litre, showing that the soda comes from the subsoil.

707 – **Relations of Certain Higher Plants to the Formation of Nitrates in Soils.** — Lyon, T. Lyttleton and Bizzell, James A. in *Cornell University Agricultural Experiment Station, Memoir* No. 1, pp. 9-109. Ithaca, N. Y., 1913.

The relation of timothy grass to the nitrogen content of the soil has been studied for six years at the Experiment Station at Cornell University.

(1) Die Salzböden Rumäniens, *Kühn Archiv*, Vol. I, p. 426.

During 1907, 1908 and 1909 nitrate determinations were made of samples of soil taken from field plats under timothy, maize and oats in rotation. The results obtained were no doubt considerably influenced by the heavy clay soil, which made the movements of nitrates very slow and hence emphasized the relationship between the plant at any particular stage of growth and the nitrate content of the soil.

Each plat was divided into sections, of which one was always kept bare but received the same soil treatment as the planted sections of the plat, thus permitting a constant comparison of the nitrates in the planted and the unplanted sections.

It was found that : 1) The nitrate content of soil under timothy, maize, potatoes, oats, millet and soy beans was different for each crop when on the same soil and there was a characteristic relationship between the crop and the nitrate content of the soil at different stages of growth.

2) During the most active growing period of the maize crop, nitrates were frequently higher under maize than in cultivated soil bearing no crop, and under a mixture of maize and millet, nitrates at this period were higher than under millet alone, although the crop yields were about the same on both plats.

3) Under both maize and oats the nitrate content was higher during the period when the crop was making its greatest draft on the soil nitrogen than in the later stages of growth, but under these crops and under millet there was no increase in nitrates late in the season when nitrogen absorption had practically ceased, although uncropped soil showed a very large increase in nitrates at that time.

4) Changes in the moisture content or in the temperature of the soil after early summer had no important effect on the nitrate content of the soil under crops.

These phenomena may be accounted for on the assumption that nitrate formation is stimulated by some processes connected with the active growth and absorbing functions of some higher plants, particularly of maize. This, together with the fact that the maize plant probably obtains a large part of its nitrogen in some form other than as nitrates, would account for the very high nitrate content of the soil under maize. The differences in the production of nitrates below different crops would be accounted for by supposing differences in the stimulating or inhibiting influences on nitrification, as well as in the relative rates, amounts and forms of nitrogen absorption.

The nitrifying power of the soil under different conditions of cultivation was determined by incubation with dried blood.

It was found that : 1) The rate of nitrification of alfalfa soil was greater than that of timothy soil ; this effect was maintained for two years after removal of the crop.

2) There is a distinct relation between the nitrifying power of a soil and the nature of the crop previously grown.

3) Nitrates were most abundant after a maize crop, the next highest being after a potato crop and the least after oats.

4) Freezing and thawing renders the soil more favourable to nitrate formation, but it is not known if this effect is due to the cold readjusting the equilibrium of the bacterial flora, or overcoming the depressing influence of some previous crop.

5) Timothy grass maintains a lower nitrate content in the soil than any other crop, and mixed grasses gave much less nitrogen in the crop and drainage water combined than was found in the drainage water from unplanted soil. This would suggest a possible explanation of the injurious effect of grass sod in orchards in which the supply of nitrogen is deficient. The influence of a crop on nitrification may be an important factor in crop rotation also.

708 – **Chemical Composition of Moor Hay provoking Excessive Licking in Cattle.** — *Communication from* HJALMAR VON FEILITZEN, *Director of the Experiment Station of the Swedish Moor Cultivation Union.*

A former field agent of the Swedish Moor Cultivation Union reported that hay from a meadow sown down on fen land had proved injurious as winter fodder for cows : they lost their appetite and fell off in condition, some even having to be slaughtered.

An investigation of the fen in question was made by the Station. The first cut had given 2 tons of hay per acre, although the farmer had given it only a light dressing of manure: 1 ¼ cwt. per acre each of super and 38 per cent. potash salts. Samples were taken from the injurious part of the 1912 hay, as well as from a fen hay and a mineral-soil hay of the 1913 crop; unfortunately no 1912 hay from a mineral soil could be had.

A botanical examination showed no marked differences : all three samples consisted of nearly pure timothy (97.6t o 97.8 per cent.), with a little smooth-stalked meadow grass, red fescue, fiorin (*Agrostis*) and foxtail ; the hay from the mineral soil contained some red and alsike clover (2 per cent.). The fen hay contained one or two pieces of *Potentilla erecta*, *Rubus saxatilis* and *Spiræa Ulmaria*. The only marked feature of the fen hay was the presence of a few brown tips to the leaves.

A thorough chemical analysis was made, comprising determination of fat, crude fibre, crude, pure and digestible protein, lecithin, ash constituents (iron oxide, alumina, lime, magnesia, potash, sodium, phosphoric acid, sulphuric acid — also sulphur in organic combination — and chlorine) ; but no defect was found in the fen hay. Naturally the total ash was higher in the hay from mineral soil ; the fat content was also somewhat higher ; fibre was rather more in the fen hay, no doubt owing to later cutting. Protein was highest in the 1912 fen hay, rather lower in the 1913 sample; digestible protein was also highest in the 1912 sample provoking " Lecksucht " (excessive desire to lick) ; indeed the feeding value shown by analysis was better in this than in the hay from mineral soil.

Of the individual ash constituents, potash was lower in the fen hay than in the mineral-soil hay ; a heavier dressing of potash would have been advisable, but that insufficient manuring cannot have caused the toxicity is shown by the fact that the normal 1913 fen hay contained even less potash than the 1912 sample. The " Lecksucht " hay contained considerably

more sodium than either of the other samples, but this cannot be considered a disadvantage since it is usual to add salt to the rations. The phosphoric acid was very low in all three samples (in hay with 15 per cent. moisture, 0.295, 0.177 and 0.293 per cent., as compared with 0.35 to 0.40 per cent. in normal Swedish hay samples), so that this cannot have been the cause; the phosphorus in organic combination as lecithin and other phosphatides is also very low (0.014 and 0.012 per cent. P in the fen hays, and 0.020 in the mineral-soil hay), but here again the slight differences are of no significance on such small quantities. Of the other constituents, only chlorine is rather high in the "Lecksucht" hay (1.05 per cent. against 0.42 and 0.50), but this of course goes with the high sodium content.

Comparative chemical analysis therefore shows no reason for the injurious properties shown by this particular fen hay.

TILLAGE AND METHODS OF CULTIVATION

709 – **Tillage Experiments in Algeria** (1). — *Bulletin de l'Office du Gouvernement Général de l'Algérie*, Year XX, No. 11, pp. 178-179. Paris, June 1, 1914.

Tillage experiments were carried out at the Agricultural School of Maison Carrée in 1913, and it would appear from the results that no advantage was gained by subsoiling the land the previous autumn; in fact, in many cases the crops of hard wheat obtained on the subsoiled plots were inferior to those on the control plots.

710 – **Trials of the Zehetmayr Method of Drilling Cereals carried out in Sweden** (2). — RHODIN, SIGURD in *K. Landtbruksakademiens Handlingar och Tidskrift*, Year LIII, No. 2, pp. 94-105. Stockholm, 1914.

The Zehetmayr method of drilling consists in planting the seed at the bottom of small furrows which serve as a protection during the winter and are flattened out in the spring by means of a special harrow. Trials of this method at the Central Agricultural Institute in Sweden did not give the good results expected; in fact in many cases the yield was lowered where this method was adopted. The failure is probably due to the mechanical condition of the rather heavy soil, a fine tilth and free working soil being necessary in order that the drill should work satisfactorily.

MANURES AND MANURING

711 – **The Influence of Lime as Quicklime and Carbonate on the Physical Condition of Various Soils.** — ENGELS, O. (Speyer Agric. Exp. Station) in *Die landwirtschaftlichen Versuchs-Stationen*, Vol. LXXXIII, Part 5 and 6, pp. 409-466. Berlin, 1914.

Experiments have been carried out as to the effect of lime in a number of types of soils: in each case soil treated with 1 per cent. of quicklime was compared with that receiving 1 per cent. of calcium carbonate and with untreated soil.

Measurements were made of the various physical properties. In general quicklime had a more marked action than the carbonate; the increase in water capacity, permeability, hygroscopicity and friability and the decrease in contraction on drying were greater in soils containing more clay, whereas the decrease in capillarity due to liming was greater in the sandy soils.

(1) See also No. 1707, *B.* June 1911; No. 2098, *B.* July 1911. (*Ed.*)
(2) See No. 1272, *B.* April 1911; No. 403, *B.* April 1913. (*Ed.*).

712 – **Influence of Straw on the Utilization of the Organic Nitrogen of Manures.** — Von May, F. in *Mitteilungen der landwirtschaftlichen Lehrkanzeln der k. k. Hochschule für Bodenkultur in Wien*, Vol. II, Part 3, pp. 433-454. Vienna, May 15, 1914.

On the effect of straw as a manure there are a great number of papers in agricultural literature. In most cases experiments on the subject have shown that manuring with straw is followed by a diminution of the crop, after which some increase may be observed in the succeeding year. Most of these experiments have been carried out in pots or on very small plots in the open. The writer has sought as far as possible to carry out his experiments under field conditions.

The two experiments here reported upon dealt with the behaviour of the plants immediately after being manured; their results are summarized by the writer as follows: The utilization of a given quantity of organic nitrogen by plants grown immediately after an application of manure suffers a depression when a substance lacking nitrogen (in this case straw) is added. The magnitude of this depression depends principally upon the ratio between the available nitrogen and the nitrogen-free organic matter, which in its turn depends upon the ratio between the composition of the manure and the quantity of nitrogen in the soil. The more this ratio varies in favour of the nitrogen-free matter the greater the depression, and under the same circumstances those plants which require their nitrogen in the shortest time suffer most. The cause of this fact is attributed to the withdrawal of soluble nitrogen by the micro-organisms of the soil, which avail themselves of the nitrogen-free organic matter as a source of energy.

713 – **On the Action of Sulphate of Ammonia and Superphosphate of Ammonia in Calcareous Soils.** — Wlodeck, J. (Institute of Agriculture of the Jagielli University, Cracow) in *Odbitka z czasopisnia Kosmos zeszyt* 10-12 *z. r.* (Article in German). Lemberg, 1913.

Two field experiments were made on calcareous and sandy soils at the Experiment Farm of the Jagielli University, of Cracow, to determine the losses of nitrogen in manuring with sulphate of ammonia and to test the effect of superphosphate of ammonia in calcareous soils. The plants used in the experiments were cereals.

When the crops obtained in these experiments on calcareous and sandy soils are compared with those obtained by the use of nitrate of soda taken as 100, the following ratios are obtained:

	Calcareous soil	Sandy soil
Nitrate of soda	100.00	100.00
Superphosphate of ammonia	91.33	91.33
Sulphate of ammonia	76.49	99.85
Without nitrogen	70.50	78.85

The action of superphosphate of ammonia was thus the same in the two kinds of soil, while that of sulphate of ammonia was lower in the calcareous soil than in the sandy one. The writer comes to the conclusion that when conditions are very favourable to the volatilization of ammonia losses up to 20 per cent. occur, and that these losses can be avoided or considerably reduced by using superphosphate of ammonia.

714 - **The Utilization of Peat in Italy.** — Summary of a Lecture by Prof. UGO ROSSI given at a meeting of the Association of Italian Agriculturists, April 20, 1914. — *Società degli Agricoltori Italiani, Bollettino quindicinale*, Year XIX, No. 10, pp. 356-361. Rome, May 31, 1914.

Several of the more important peat beds in Italy have been worked chiefly with a view of utilizing the peat as fuel. Most of the peat is however too poor to compete with imported coal, hence the lack of success of all such undertakings even where they were connected with land reclamation schemes. Attempts have also been made to use peat for other purposes, such as litter, packing and isolating material, etc., but the quantities thus used are too insignificant to be of any economic importance. Of late, however. the nitrogen contained in peat has attracted considerable attention ; this nitrogen is practically in an inert condition in the raw material and in order to utilize peat successfully as a manure, the nitrogen must be transformed into a more active compound such as a salt of ammonia.

The idea of subjecting peat to the water-gas process was suggested by Dr. L. MOND and the first plant erected for the purpose was that at Orentano in the province of Lucca, Italy ; it has since been much improved by the addition of plant for preparing and drying the peat. The next important works of the kind were those at Osnabruck (Hanover) under the direction of Drs. FRANK and CARO, but owing to the difficulties connected with the preparation and drying of the peat, these works may be considered as being still in the experimental stage, as are other works started in England. The last works to be erected were those at Codigoro, Italy, where all difficulties have been successfully overcome. In fact the only two important undertakings for the utilization of peat are those of Orentano and Codigoro belonging to the " Società per l'utilizzazione dei combustibili italiani ".

The process adopted for treating peat is the following : The peat, properly dried and broken up, is thrown into a turret-shaped oven 26 to 33 feet high, called the gas oven, which is fed at intervals from the top. The peat burns only in the lower part of the turret, the combustion being regulated by a jet of hot air and steam. The water vapour decomposes on the incandescent mass, producing, together with the other combustion gases, the so-called water gas, or in this case Mond gas, which collects in the top of the oven. It is produced at the lowest possible temperature and the nitrogen evolved from the peat combines with the nascent hydrogen and forms ammonia. The gas thus produced is then washed to free it from the tarry products it contains and led into a leaden chamber where it is met by a spray of sulphuric acid which converts the ammonia into sulphate, while the remaining gas is purified,

cooled and burned under the steam boilers, in the drying ovens or in gas motors. In this way about three-quarters of the quantity of nitrogen contained in the peat is converted into sulphate of ammonia. A peat containing 2.5 per cent. of nitrogen yields about 175 lbs. of sulphate of ammonia to the ton.

The first factory was erected at Orentano in 1907, but only began to work in 1910. At first the peat was dried in the open, but as this system proved quite unsatisfactory artificial drying was resorted to. Peat taken from the pit contains 50 per cent. by weight of water, and this quantity is now most successfully reduced to 25 per cent.

At present 1800 cu. ft of peat can be treated daily, yielding 50 tons of sulphate of ammonia per month, and before long the output will be doubled. The gas is used in the works and at a central station developing about 800 H P.

The results obtained at Orentano encouraged the company to erect large works at Codigoro (Ferrara, Italy) in 1912 ; these are now capable of dealing with 150 tons of dried peat daily and of turning out from 10 to 12 tons of sulphate of ammonia per day. The peat beds at Codigoro are upwards of 2500 acres in extent. The Company has already spent £240 000 on the two factories, but it can now produce sulphate of ammonia at 4*s* 10*d* to 5*s* 7*d* per cwt. while the market price is above 12*s* per cwt.

715 – **Talbot Slag**. — DAFERT, O. in *Zeitschrift für das Landwirtschaftliche Versuchswesen in Oesterreich*, Year XVII, Part 5, pp. 301-302. Vienna, May 1914.

The " Talbot slag " obtained in the manufacture of steel by Talbot's process differs very little in outward appearance from ordinary basic slag.

According to the results of four analyses its composition varies as follows :

	Talbot slag		Basic slag. Average according to F. W. Dafert	
	Range per cent.	Average per cent.	I (*) per cent.	II (**) per cent.
Mg O	3.75 – 4.60	4.25	2.97	—
Ca O	45.70 – 50.42	48.10	47.33	45.26
Mn O	3.50 – 6.46	4.91	4.51	6.44
$Al_2 O_3$	3.58 – 7.48	5.28	1.87	—
Fe O	5.45 – 9.23	7.34	10.85	—
$F_2 O_3$	2.75 – 7.35	5.25	5.38	—
$Si O_2$	8.86 – 10.04	9.48	8.34	8.83
$P_2 O_5$	14.01 – 17.90	15.99	17.38	18.49
S	0.22 – 0.88	0.51	0.42	—
$S O_3$	traces – 0.16	0.08	0.28	—

(*) According to an older analysis. — (**) According to recent analysis.

The citric-acid-soluble phosphoric acid ranges from 74.2 to 90.1 or an average of 81.3 per cent. of the total phosphoric acid ; it is thus within the usual limits of basic slag, from which it does not appear to differ much as a fertilizer. Manurial experiments now being carried out at the Vienna Experiment Station for Agricultural Chemistry will soon settle this point.

716 - **The Effect of one Crop upon Another.** — The Duke of Bedford and Pickering, S. U. in *Journal of Agriculture Science*, Vol. VI, Part 2, pp. 136-151, + 1 plate. Cambridge, May 1914.

The writers review the results of the investigations on the effect of growing grass over the roots of fruit and other trees carried out at Woburn since 1895, and give an account of recent work on the effect of grasses and clover on various crops and on each other. In addition to field experiments, trees were grown in pots fitted with annular trays. Both metal and earthenware trays were used. The ratio of the weight of soil in the pot to that in the tray was 31.9 and the relative surface of the grass-grown soil in the tray to the surface of the pots was 1:2. All the water required to keep the pots up to a given weight was put into the trays. The dry weight of the matured crops was used to determined the effect of the different conditions.

Out of 23 instances only four showed a favourable effect and in 12 instances the effect of grass in the trays was to reduce the crop in the pots to an average of about one-half. The reduction varies with the crop, tobacco being more sensitive than tomatoes and mustard, and these more sensitive than barley. In the case of tobacco the amount of the reduction was proportional to the growth of grass, and, in a former experiment where the effect of 18 different grasses on apple trees was examined, the magnitude of the effect was found to vary with the vigour of the grasses.

Since the smaller crops (*i.e.* those in the pots below the grass-grown trays) remove less nitrogen from the soil, the soil in these pots should be richer in nitrogen than those without grass. Analysis of the soils showed this to be the case. Therefore the reduction in the growth of the crops under grass must be due to some toxic substance which reduces the power of the crop to utilise the available plant food.

Removal of the trays containing grass before maturity resulted in a great increase in the growth of the crop, so that the plants not only made up for lost lee-way, but actually outstriped those without grass. This effect was undoubtedly due to the destruction of the toxic substance by oxidation with the formation of beneficial products. Leachings from growing grass, if oxidised, were found to be beneficial instead of toxic, and it has been found that soil removed from grassed ground is more favourable to the growth of trees than that from similar tilled ground. Further, it is possible that partial grassing might have a beneficial effect, when the grass is at such a distance from the tree roots that the toxin becomes oxidised before reaching these roots. This was found to be the case at Woburn : apple trees with grass at a distance of 3 ft. from the stems grew more rapidly for a time than trees with grass 6 ft. away or with grass up to the stems.

Recovery from the toxic effect may not always occur, for this effect may produce permanent injury, especially in the case of hard-wooded plants.

The toxic effect between the same plants is greater than that between different plants. Also, the toxic effect of heating a soil is much greater than that produced by the growth of a crop in both cases the toxin, after oxidation, increases the fertility of the soil. There is therefore no reason for assuming that the toxin is an excretion from the plant, the debris from the growing roots being probably sufficient to account for its formation.

717 – **The Action of Certain Nutrient and Non-nutrient Bases on Plant Growth** (1). — McCool, M. M. in *Cornell University Agricultural Experiment Station, Memoir* No. 2, pp. 121-216, figs. 1-15. Ithaca, N. Y., August 1913.

I. *The antitoxic action of certain nutrient and non-nutrient bases with respect to plants.*

An extensive series of experiments has been made on the toxic and antidotal action of various ions on plant growth, particularly with respect to the elongation of the roots of seedlings. The chief conclusions of these experiments are as follows:

1) Each of the following radicles (in the order given) is poisonous to seedlings: Ba, Sr, NH_3, Mg, Na, K.

2) Mutual antagonism exists between the following pairs of cations when present together in solution:

Mg and Sr	Na and K
K and Sr	Na and NH_3
Na and Sr	K and Ba
Mg and Ba.	

3) Calcium is the most effective of any of the substances studied in preventing toxic action.

4) Protective action is not confined to the so-called essential nutrients; Na, Sr and Ba (the non-essential ions) also possess this property.

The injurious action resulting when unbalanced conditions prevail, and the importance of calcium in correcting this action, make it probable that in many cases the beneficial effects obtained from calcium compounds are due to antagonistic relations. In any event the general trend of results indicates that where any single fertiliser has proved injurious it would be useful to apply a calcium compound, at least in limited quantity. Various theories have been advanced regarding the causes of antagonistic action between different ions, and the writer has made experiments which show that the permeability of the cell is altered, details of which will be published later.

II. *The toxicity of manganese and the antidotal relations between this and other cations with respect to green plants* (2).

Pure solutions of manganese salts are extremely poisonous to pea and wheat seedlings. The degree of toxicity is greatly reduced in full

(1) See also No. 13, *B.* Jan. 1914.
(2) See also No. 613, *B* July 1914. (*Ed.*).

nutrient solutions and in soil cultures. The injurious action appears chiefly in the upper portions of the plant, chlorosis being the first indication of an overdose. Protection from light diminishes the injurious effects. Calcium, potassium, sodium and magnesium ions are each effective in counteracting the poisonous action of manganese.

III. *The toxicity of various cations.*

Comparative studies of the poisonous action of the chlorides of calcium, potassium, sodium, magnesium, ammonium, barium, strontium and manganese in distilled water, in full nutrient solution and in soil cultures have been made. The concentrations in which no further elongation of seedlings takes place, those in which slight growth occurs and those that result in no injury to seedlings have been determined. Field pea seedlings were employed as indicators and in some cases wheat seedlings were also used. It was found that :

1) Calcium ions are the least toxic and require concentrations only a little lower than those causing plasmolysis to inhibit growth.

2) No appreciable root growth appears in solutions stronger than

$\frac{N}{50}$ KCl, $\frac{N}{75}$ NaCl, $\frac{N}{500}$ $MgCl_2$, $\frac{N}{1000}$ NH_4Cl, $\frac{N}{4000}$ $BaCl_2$ and $\frac{N}{5}$ $SrCl_2$.

3) In full nutrient and soil cultures, the lethal concentrations of the various bases with the exception of strontium and barium, are practically identical, namely $\frac{N}{3}$ to $\frac{N}{5}$.

4) Under experimental conditions, much stronger solutions are required to prevent top growth than to kill the roots of seedlings.

5) Seedlings that have grown for 10 days in either distilled water, tap water, or full nutrient solutions, are far more resistant to any toxicant studied than are those that are placed immediately in the toxic solutions.

6) The chlorides of ammonium, magnesium, potassium, and calcium, in the order given, are injurious to germination in pure solutions and in soil cultures. These results suggest that fertilisers should be judiciously applied to soils.

An extensive bibliography and a review of previous work on this subject is also given.

718 – **Edible and Poisonous Fungi from the Nancy District.** — BERTRAND and SARTORY, A. in *Bulletin des séances de la Société des Sciences de Nancy*, Series III, Vol. XIV, No. 2, pp. 82-214. Nancy, April-July 1913.

An account of the edible, poisonous, and innocuous fungi, together with a key for identifying the Agaricineae, Polyporeae, Hydneae, Clavarieae, Lycoperdeae, Morchelleae, Helvelleae and Pezizeae. Vernacular and scientific names are given ; the distribution of the species according to the various soils is discussed ; toxicity, poisons and antidotes are also discussed.

PLANT BREEDING

719 – **Inheritance of the Capacity for Production.** (1) — Roemer, Th. in *Fühlings Landwirtschaftliche Zeitung*, Year 63, Part 8, pp. 257-268. Stuttgart, April 15, 1914.

Opinions are still divided as to the importance of Mendelian laws for breeding practice. The chief reason for this is the prominence given in agricultural breeding work to "performance", that is to the combined action of a more or less complex series of characters of a biological nature, which are much more difficult to observe and test than morphological ones. At the same time, the inheritance of such biological characters has been tested in a considerable number of cases, including: fertility in *Stizolobium*, self-sterility in *Cardamine pratensis* and *Reseda*, pollen sterility in potatoes, size of grain in maize, flintiness and flouriness in wheat and maize, chemical composition of the seed in maize, hardiness in wheat, resistance to cold in *Mirabilis*, flowering-time in peas, production and quality of leaves in tobacco, standing power in wheat, rust-resistance in wheat, time of ripening in wheat, oats, barley and maize, discontinuity in the ear in barley, annual and biennial condition in *Hyoscyamus*, power of growth in ducks, fertility in hens, temperament in dogs, defects of vision (non-traumatic) in horses.

These investigations have shown that there is no essential difference in mode of inheritance between morphological and biological characters. In the splitting up in the second generation, however, biological characters show a preponderance of the ratio 1 : 2 : 1 over the ratio 3 : 1. These biological characters appear to be the expression of a number of units; this makes the investigation of the Mendelian inheritance of the capacity for production very difficult, as numerous slight variations which cannot be successfully grouped arise in the second generation.

From the above, the importance of Mendelism in breeding for productivity is already evident. As a complete analysis of the hybrids according to their capacity for production appears not to be possible, agricultural breeding work cannot make use of Mendelian laws to the same extent as some branches of horticultural work, in which the results of certain crosses can be predicted. At the same time we have to thank the new studies of heredity for the knowledge that in the crossing of two races all the possible combinations of the unit characters borne by each will turn up; further, that an abundant second generation will already show just what can be reached as the result of any particular cross, and that the progeny of an individual is the only sure test of its hereditary disposition and therefore of its breeding value, outward appearance being quite unreliable. These points hold for all types of breeding, while in breeding for productivity the knowledge that we can obtain forms surpassing the more productive of the two parents, and at the same time combining the valuable characters of both parents in a new and favourable manner, is highly important; in practice it allows an improvement in productivity to be obtained by crossing forms of equal productive power, that is to say without having to resort to parents which

(1) See also No. 1547, *B.* Nov. 1912; Nos. 490 and 495, *B.* May 1913; No. 959, *B.* Aug. 1913; and No. 1045, *B.* Sept. 1913. (*Ed*).

may combine extremes of the desired character with insufficient development of other characters of production. As this departure from the average invariably appears in the second generation and can be determined in the offspring of these individuals, that is in the third generation families, the breeder may already reach a definite result by this third generation, without any fear of valuable material being unwittingly discarded.

720 – **International Factors connected with the Physiology of Germination in Wheat Grains.** — NILSSON-EHLE, H. (Svalöf, Sweden) in *Zeitschrift für Pflanzenzüchtung*, Vol. II, Part 2, pp. 153-187 + 1 plate. Berlin, April 1914.

The following results have been reached after many years' study of the germination and anatomy of wheat.

1. The rapidity or slowness of germination immediately after ripening is a hereditary character distinctive for different varieties, and in the offspring of crosses shows decided segregation on the usual lines.

2. This physiological character is shown, both by comparison of different varieties and strains and by segregation after crossing, to be in the main independent of hardiness (Winterfestigkeit) and early ripening, which characters depend on other internal factors. It is possible to combine high or low resistance to germination with high or low hardiness and early-ripening properties.

3. These differences in germination characters between different varieties of wheat are connected with a series of internal hereditary factors.

4. Among these factors, that of « redness », which produces the red colour of the grain, is of special importance in hindering germination immediately after ripening. The white wheats, which generally lack red factors, germinate most readily; next come those with a single red factor, while those with several red factors germinate most slowly.

5. The germination characteristics of the different varieties are only partially dependent on the red factor; other internal factors act as co-determinants. In particular readiness to germinate and the specific course of this condition in individual varieties are probably independent of the red factors and dependent on other internal factors; at the same time the red factors act in preventing germination in the same direction as insufficient ripeness.

6. The observed facts throw fresh light on the important part played by the pericarp in the physiology of germination; the principal action is no doubt exerted by the corky layer, to which Schröder attributes regulation of the permeability and in which the red factor is localised.

7. The white and one-factor red wheats examined show somewhat more rapid absorption of water than those with more than one red factor.

8. The action of the red factors in hindering germination is at any rate partly exerted through their influence on the structure of the pericarp. In the absence of red factors the inner integument is thinner and more delicate than otherwise.

9. The pericarp consists of two quite separate integuments, insoluble in concentrated sulphuric acid; in red varieties each consists of two layers

of cells, while in white varieties the inner one is quite structureless in the ripe grain.

The writer considers this demonstration of a physiological characteristic composed of a number of internal factors as of considerable theoretical importance ; the proof of this has been facilitated by the circumstance that the simultaneous morphological action of the factors is readily observable.

These observations are also in support of the theory that adaptation takes place by accumulation or some other type of combination of various hereditary factors.

It certainly seems that cultivated plants are more adapted for the study of general biological questions than wild ones, owing to the great variety of forms protected under cultivation ; wild species, on the other hand, may often contain only adapted forms in which all the factors for a particular character are present together, preventing the possibility of any genetic analysis.

721 – **Xenia in *Phaseolus* Crosses.** — DANIEL, JEAN, in *Revue horticole*, Year 86, No. 11, pp. 253-257. Paris, June 1, 1914.

The Spanish bean (*Phaseolus multiflorus*) was crossed with the black Belgian bean (*P. vulgaris nanus*) and the resulting progeny were investigated more especially with regard to xenia (*i. e.* the reaction of the hybrid embryo on the surrounding tissues in the seed) exhibited by the seed coat.

The Spanish bean is large and spotted black and violet, while the Belgian bean is small and has a shiny black surface. Pedigree seed was used in the experiments. The pods obtained as a result of the cross in 1910 contained seeds in size and shape like those of the Spanish bean, but in colour shimy black like those of the male. The same cross in 1912 gave three kinds of pods : some which contained shiny black seeds, some which contained seeds of a chocolate brown colour and others whose seeds were light dun, showing that xenia may vary in intensity according to circumstances.

In all cases, sections showed that the pigment in the cells of the testa was the only character affected.

Two of the 1910 progeny mentioned above were sown in 1911. The resulting plants were exactly like the female parent (*i. e.* Spanish bean with red flowers); they were selfed, producing spotted seeds which were sown in 1912. In this next generation all cotyledons were hypogeous as in the maternal parent, which they also resembled in having the climbing habit. The flowers however were of three types : some plants had red flowers like the maternal parent ; others had red standards whith wings and keel white or white with red spots ; others again had flowers of a dirty white colour. The all-red flowers yielded nothing but purple spotted seeds of various shades ; the red-and-white flowers yielded brown spotted seeds and the white flowers yielded white seeds more or less reticulated (1).

(1) See No. 115, *B.* Feb. 1914. (*Ed.*).

A plant belonging to each type was again selfed, and the resulting seeds again showed segregation, but without the recurrence of violet flowers or black testa.

722 – **The Inheritance of Germination Energy, Germination Capacity and Sensitiveness to Light in Seeds of *Poa pratensis*.** — PIEPER, H. in *Fühlings Landwirtschaftliche Zeitung*, Year 63, No. 10, pp. 362-368. Stuttgart, May 15, 1914.

As the result of a series of tests with seeds of *Poa pratensis*, the variations of germination energy, of germination capacity and of sensitiveness to light appeared to be hereditary characters in the different strains. The possibility of using this fact in breeding work will depend on the correlation of the above characters with other desirable ones, the existence of which did not become apparent in the trials. Neither was it possible to decide from the trials whether the differences observed in the germination capacity were due to the structure of the seed or to that of the fruit.

723 – **Researches on the Germination Capacity and on the Capacity of the Plumule to Emerge from the Soil.** — GISEVIUS and CLAUS in *Fühlings Landwirtschaftliche Zeitung*, Year 63, Part 9, pp. 297-318. Stuttgart, May 1, 1914. AGRICULTURAL SEEDS

The writers compare the germination capacity with the capacity of the plumule to emerge from the earth or from the layer of sand covering the seeds. They experimented upon 9 samples of winter rye, 42 of winter wheat and 24 of spring barley. The determination of the germination capacity was carried out at different times, according to the regulations of the Union of Agricultural Experiment Stations, in a germination box provided with ventilation and a thermostat, and always with four samples. The determination of the capacity of emerging was made in Hiltner boxes; these were partially filled with quartz sand the grains of which did not exceed 1 mm. in diameter; the seeds were pressed into this and covered with a layer 3 or 5 cm. deep of coarse sand (1 to 2.5 mm. diameter) which would not form a crust over the sprouting seeds. In this case also four tests were made for each sample. These boxes were placed in a room kept at the most uniform temperature possible of about 18° C.

The result of the investigation into the capacity of emergence of the plumule in rye, which was tested 100 and 160 days after harvest, was the following: if the determination of the energy and capacity of emergence of the plumule are to be determined by the same method as the energy and capacity of germination, the figures obtained on the 7th and 12th day using a covering of 3 cm. of sand are considered suitable. It is not yet known whether this would be the case also in spring (these experiments were made in November and January). The 5 cm. covering of sand did not offer any advantage over the 3 cm. covering.

Wheat was tested 33 and 153 days after harvest, barley 70 and 160 days after, but for oats the tests were not complete; for all three the same conditions as for rye may be taken.

It appears that the capacity of germination is generally greater than the capacity of emerging. As it was not possible to carry out both determinations immediately after reaping, a complete judgment on the significance

Report on seed examined in April 1914.

Kind of seed	Country of origin	Weed seeds		Other seeds		Percentage of non-germinable seeds	Percentage of diseased seeds	Quantity examined	Remarks
		Species	Per-centage	Species	Per-centage				
Dutch clover (*Trifolium repens*) . . .	England	*Crepis capillaris*	0.02	*Trifolium pratense*	0.01	1.24	*nil*	½ oz.	A little grit present.
		Prunella vulgaris	0.10	*Plantago lanceolata*	0.57				
		Amaranthus retroflexus	0.04	*Phleum pratense*	0.02				
		Rumex Acetosella	19.26	*Holcus lanatus*	0.02				
				Cichorium Intybus	0.02				
Dutch clover (*Trifolium repens*) . . .	New Zealand	*Rumex Acetosella*	3.05	*Plantago lanceolata*	0.42	3.25	*nil*	½ oz.	
		Prunella vulgaris	0.01	*Phleum pratense*	0.04				
				Medicago lupulina	0.04				
				Cichorium Intybus	0.14				
Niger seed (*Guizotia abyssinica*)	India	*Cuscuta* sp.	0.77	*Sesamum indicum*	8.65	*nil*	*nil*	1 oz.	A large percentage of sand present.
		Raphanus Raphanistrum	1.04						
		Amaranthus retroflexus	0.95						
Niger seed (*Guizotia abyssinica*)	India	*Cuscuta* sp.	0.38	*Sesamum indicum*	1.56	*nil*	*nil*	1 oz.	A large percentage of sand present.
		Raphanus Raphanistrum	0.37						
		Amaranthus retroflexus	0.34						

of the capacity of emerging is not yet possible. These experiments have, however, shown that there is a practical method for determining the capacity of emergence and that the greater amount of time required by the test is not so considerable as to prevent its being used instead of that for germination capacity ; the emergence test is in itself more precise and, as these still incomplete experiments seem to point out, allows the concurrence of factors influencing the sprouting of seed, such as the effect of saline solutions or of an attack of *Fusarium*, to be distinctly recognised.

724 – **Impurities in Seeds in Victoria, Australia.** — *Communicated by* S. S. CAMERON *Director of Agriculture.*

(See table on opposite page).

725 – **Researches on the Ears of Wheat and of Spelt for the Precise Characterisation of Varieties.** — KONDO, M. in *Landwirtschaftliche Jahrbücher*, Vol. XLV, Part 5, pp. 713-817 + 3 figs. Berlin, 1913.

CEREAL AND PULSE CROPS

These investigations extended to 62 winter wheats and 20 spring wheats (of which 80 were *Triticum vulgare* Vill.) and 16 spelts (*T. Spelta* L.). They were all of them of the 1911 crops and either bred at Hohenheim or the second crop from the original seed. Of each variety about thirty ears were selected and from these five typical ones were again picked out (large, medium and small) ; of each the awns, colour of the glumes, the presence of hairs, density of spikelets, weight and size of the ear, and colour of seed, were observed. Further investigations were made for each variety on groups of three ears (heavy, medium and light) as to the distribution of weight of the grains and spikelets in the ear and as to the constitution of the grains.

The results are the following : In common wheats the ears possessing medium density always show the highest weight of ear, the highest grain weight of ear and the greatest weight per thousand grains. In the dense-eared wheats the decline in the grain weight towards the tip is greater than in the medium or loose-eared ones. In the upper end of the ears the grains are much smaller than in the lower end. In medium and loose ears the weight of the grains is relatively the same. The best form of ear of common wheat is not the dense club form, but the medium parallel-sided form.

In spring wheat in general, the weight of the ears, of the total grain and of the thousand grains, as well as the number of ears and grains, are much lower than in winter wheats. The weight of the ears and of the grain of spelt are almost the same as in spring wheat. The number of grains in spelt is much inferior to that in winter and spring wheat. On the other hand the thousand-grain weight is higher. The belt of the heaviest grains in the ear varies according to the several varieties ; in some it is in the central third of the ear, in others on the border between the central and lower third, or in the middle and lower third and often in the upper third. In the dense ears the belt is mostly on the limit between the lower and middle third. In the medium dense and loose ears it is in the middle third. In winter wheats the belt of the heaviest grains is scarcely ever in the upper

third, while in spring wheat it is most frequently in the middle or in the upper half of the ear. In spelt it is mostly in the middle of the ear and very rarely in the upper third.

In general it can be stated that in winter and spring wheat and in spelt the number of grains in a spikelet and the average grain weight are at their highest in the middle third of the ear. The ratio between the bottom and the top third is not constant, and varies according to the variety and species. In winter wheat in general, the lowest third is superior to the highest in every respect ; in spring wheat the number of grains in the upper third and the individual grain weight in the lower third are at their lowest. In spelt the number of grains is smallest in the lower third and the individual grain weight is least in the upper third.

The distribution of grains in the ears is characteristic of the several varieties. In general the length of the rachis, the number of grains, the total grain weight and the thousand-grain weight vary with weight of the ear, but inversely with the density of the spikelet and the number of sterile spikelets in the lower part of the ear. The ratio between weight of ear and the number of spikelets and the density of the grain is not constant. It is therefore not advantageous to endeavour to breed wheat for greater density of spikelets, but it is very important to improve the lower part of the ear.

As for the colour of the grain, which depends upon various conditions, white and red may be assumed to be the fundamental colours which form the characters of the different varieties. The colour depends chiefly upon the pigment in the pericarp and only secondarily upon the mealiness or flintiness. In each ear the colour of the grain is quite uniform.

The form of the full grain and the presence or absence of the depression in the longitudinal furrow on the flat side of the grain are to be considered as characters of the variety. The hairs at the tip of winter and spring wheat grains are thick-walled, with narrow lumen, and straight ; they vary in length according to the variety. The hairs of spelt possess relatively thin walls, and large lumina ; they are often twisted and are longer than in common wheat. The length of these hairs is a character of the variety.

The writer considers size and weight of the wheat grains as to a certain degree characters of variety and species ; mealiness and flintiness are also characters of variety in spite of the fact that they are not invariable.

An important character for the determination of variety and species is the middle layer of the four which make up the pericarp in the species of *Triticum*.

726 - **Six Years' Trials of Winter Wheats in Denmark (1907-1912).** — From Report of the Danish Crop Experiment Organisation (1). — *Communicated by the Committee on Plant Breeding.*

These trials were carried out at the Experiment Stations at Abed (Lolland) and Tystofte (West Zealand) ; the experiment ground is in each case on a good loam.

(1) A full report is given in *Tidsskrift for Landbrugets Planteavl*, price 6 kr. (6s 7d) the vol. of 800 pp.

At Tystofte two series of trials were made each year, one after bare fallow and the other after a fallow cropped with turnips; at Abed the wheat was always sown on bare fallow land. In each trial there were 6 to 8 adjacent plots of $^1/_{200}$ tondeland (33 sq. yds.) in area ; on every third plot Tystofte Standwell was grown for comparison. Altogether 23 varieties were grown, 8 of them in all the trials; the yields of the others were calculated in comparison with the average of these eight.

The winters were on the whole favourable ; in one of the six trials at Abed some damage was done, but at Tystofte none. For this reason the less hardy varieties gave relatively high yields.

Heaviest croppers. — A yield of 43 to 44 ctn. per tondeland (58 to 59 bushels per acre) was given by : 1) Queen Wilhelmina II, 2) Tystofte Small II, and 3) Tystofte Standwell II. All three are improvements on the originals of the same name obtained at Tystofte ; they none of them differ from their originals except in giving 8 to 10 bushels more grain.

Queen Wilhelmina II gives a very heavy yield under favourable conditions ; it is not very tall and tillers relatively little, but stands very straight ; it is, however, not very hardy, about equalling the ordinary Squarehead.

Tystofte Small II can be relied upon to give a heavy yield ; it tillers rather more than the preceding, but is somewhat liable to lodge.

Tystofte Standwell II has a rather shorter and stiffer straw than the Small; it is very hardy and tillers well, but for this reason may grow too thick and become liable to lodging or to imperfect development of the grain ; it stands late sowing better than the other two. At Tystofte it gave a lower yield than the Small after bare follow, but beat the latter after a cropped fallow.

Second group. — The following gave a yield of 39 to 41 ctn. per tondeland (52 ½ to 55 bushels per acre) : 4) Abed Large-eared, 5) Svalöf Extra Squarehead II, 6) Svalöf Grenadier II, 7) Carter's Standup, 8) Webb's New Standup, and 9) Svälof Sun.

Abed Large-eared tillers fairly well, is only moderately hardy, but stands very straight ; with favourable weather it gives a plentiful crop of grain ; the bushel-weight is below the average.

Of the Svalöf varieties, Extra Squarehead II is very hardy, Grenadier II only moderately so ; these give some 2 to 4 bushels more than the older varieties of the same names. The Sun wheat is very hardy ; at Abed it did better than the other two, but at Tystofte less well.

Webb's and Carter's Standup wheats are very much alike ; they tiller little, are not very hardy and have short and stiff straw ; under favourable conditions they are heavy croppers and at the same time stand up well.

Light croppers. — Yields of 33-37 ctn. per tondeland (44 ½ to 48 ½ bu. per acre) were given by : 10) Tystofte Bearded, 11) Strube's Bearded No. 56, 12) Scotch Squarehead from Lidsö, 13) Strube's Squarehead, 14) Erh. Frederiksen's Squarehead, 15) Bencard's Red, 16) Svalöf Auger, and 17) Abed Lancet.

Minnesota No. 529 gives only 24 ctn. (31.3 bu. per acre) of grain.

727 – **Field Trials with Spring Wheat** (1) **and Oats in Germany in 1909-10.** — 1. ZADE, A. Haferanbauversuche auf leichteren Böden 1909-10. — *Arbeiten der Deutschen Landwirts-Gesellschaft*, No. 252, 99 pp. — 2. ROSE, H. Sommerweizenanbauversuche 1909-10. — *Ibid.*, 59 pp. Berlin, 1913.

I. *Trials of oats on light soils.*

The number of experiments was 50 in 1909 and 56 in 1910 ; they were distributed over the whole of Germany. The three varieties taken in the main trials were : Leutewitz Yellow, F. von Lochow's Yellow and Svalöf Golden Rain.

The reports are drawn up like those of the other variety trials made by the German Agricultural Society. The positions of the three varieties as regards the various qualities are shown in the following table :

	Yield of grain		Yield of straw		Resistance to lodging		Bushel weight		Percentage of chaff (1)	
	1909	1910	1909	1910	1909	1910	1909	1910	1909	1910
F. von Lochow's Yellow. . .	I	I	III	III	II (2)	III	II	II	I	I
Svalöf Golden Rain.	II	III	I	I	I	I	I	I	II	II
Leutewitz Yellow.	III	II	II	II	II (2)	II	III	III	III	III

(1) I = lowest. — (2) Equal 2nd.

It is seen that the results for the two years are fairly concordant.

II. *Trials of spring wheats.*

The trials of wheats were made at 37 places in 1909 and 38 in 1910. The varieties taken for comparison were Rimpau's Red Schlanstedt for early sowing, good soils and favourable weather conditions, and Strube's Bearded for later sowing, light soils and unfavourable weather conditions ; the other trial varieties were Heine's Japhet and Wohltmann's Blue Dame.

The average yields of grain of the four varieties are shown in the accompanying table (in lbs. per acre).

	Comparison of all four varieties		Comparison of three varieties	
	1909 (13 trials)	1910 (10 trials)	1909 (12 trials)	1910 (19 trials)
Rimpau's Red Schlanstedt	2 865	2 040	2 700	2 358
Strube's Bearded	2 579	2 158	—	—
Heine's Japhet.	2 869	2 032	2 740	2 410
Wohltmann's Blue Dame	2 654	1 828	2 643	2 200

(1) For loose-eared varieties of winter wheat, see No. 227, *B.* March 1914 (Abstract of *Arbeiten der D. L. G.*, No. 248). (*Ed.*).

Rimpau's Red and Heine's Japhet are seen to be very nearly equal, while Blue Dame comes decidedly behind them. Strube's Bearded was the best in 1910 under certain circumstances, such as soils hardly to be classed as wheat land, unfavourable places, or East German continental conditions with low rainfall. For straw yield Rimpau's Red and Strube's Bearded came off best ; Blue Dame was lowest in this respect, but at the same time the most resistant to lodging. Strube's Bearded showed the shortest period of growth in each year ; it also gave the flintiest grain.

Results of preliminary trials of other varieties are also given.

728 – **The Early Fruwirth Goldthorpe Barley.** — WACKER, H, in *Zeitschrift für Pflanzenzüchtung*, Vol. II, Part 2, pp. 233-248. Berlin, April 1914.

The writer describes the origin of the Early Fruwirth Goldthorpe barley, which is a pure line in Johannsen's sense ; it is descended from a plant observed by Fruwirth in 1899 in a field of Goldthorpe barley on the experimental ground of Hohenheim Agricultural College. The variety, which the hairs on the rachilla shew to belong to *Hordeum distichum erectum*, is described as follows: It exhibits a close-set ear of medium length, with fairly wide spreading awns. The grain is of medium length and stout, of a yellowish-white colour, with rather narrower glumes than ordinary Goldthorpe barley, and has a high starch content. The stem is of medium length, rather thin, but wiry and strong, and therefore does not easily lodge. The yielding capacity is excellent, and ripening takes place 8 or 10 days earlier than with ordinary Goldthorpe barley. Smut occurs very rarely, as the spikelet remains closed after flowering. This fact also precludes any chance of cross-fertilization. Nevertheless, in 1908 some plants appeared among the descendants of plants selected in 1899-1902 for early maturity and grain yield and simply allowed to multiply from 1902 to 1907, which produced descendants differing from others in the colour of the grain and in the strength of the stem. According to the writer, spontaneous variations within the pure line must therefore have occurred.

Cultivation is now being carried on with a view to further improving the variety, which has been included in the Register of the German Agricultural Society.

729 – **Formation of Aerial Tubers in Potatoes.** — FOITIK, TH. in *Monatshefte für Landwirtschaft*, Year III, Part 5-6, pp. 111-120 + 3 figs. Vienna and Leipzig, 1914.

The writer has observed the occurrence of aerial tubers in the potato varieties Topas (since 1910) and Marius, and occasionally in a selection from Prof. Wohltmann. These tubers occur on the main stem and branches, singly or in clusters, and may be as big as pigeon's eggs ; they are grass-green with purple spots. They often bear nodosities, from which, or from the tubers themselves, rosettes of soft leaves may arise. The formation of aerial tubers takes place especially on haulms which have got bent down to the ground, but in this case the tubers may be of normal size. The writer believes the occurrence to be favoured by heavy manuring combined with cool damp weather.

On planting some of the 1910 aerial tubers of Topas, yields were obtained in 1912 and 1913 heavier than the average of the variety.

730 – ***Dalembertia populifolia*: an Edible Plant in Mexico.** — Bois, D., and Diguet, L., in *L'Agriculture pratique des pays chauds*, Year XIV, No. 134, pp. 257-265. Paris, May 1914.

Dalembertia populifolia Baillon, known as " Jicama de baryta " or " Jicama del cerro ", is a shrub; at certain times of the year its roots produce tuberous swellings which are edible and are sold in large quantities in Central Mexico. The plant only exists in the wild state and to collect the tubers, which are usually close under the surface of the ground, a hole is first dug close to the stem, and the roots are followed horizontally, care being taken not to injure the base of the stems, as the plant is perennial. The writers cultivated the plant experimentally and found that it could be propagated by seeds and cuttings, but that the tubers could not be used for this purpose. Though containing little nutritive matter, *Dalembertia* is popular as an article of diet, either cooked or raw, and is eaten either alone or with other foods; it is of special value for quenching thirst on a long march in the burning sun.

FORAGE CROPS. MEADOWS AND PASTURES

731 – **Observations on the Laying-down and Care of Permanent Pastures.** — Elofson, A., in *Svaenska Mosskultur-Föreningens Tidskrift*, Year 27, No. 2, pp. 77-95. Jönköping, March 1914. (From the writers summary).

The writer begins by calling to mind the great importance of cattle-breeding in relation to the national food supply, as well as to agriculture, especially in districts unsuited to arable farming. With the aid of control societies, a gross return had been reached in cattle breeding such as could scarcely have been dreamt of before, but those stock-farms which were carried on on highly intensive lines were now merely marking time, or even declining, both as regards their milk-production, and also in return per 100 food units. The zenith, as regards the capacity of the animals, had therefore been reached, and the net returns now no longer corresponded to the high gross figures.

The writer sees the reason for this in the fact that too much stress has been placed on the results of chemico-biological research in scientific cattle feeding, without reference to the great demands of biology, an omission which is bound to bring retribution, since the attainments of the animals must always in the long run depend on their constitutions. The fruits of intensive, unnatural stall-feeding are decreased power of resistance, lessened reproductive power, etc.: hence great expense in rearing fresh stock, and less complete utilization of raw foodstuffs.

The main food should consist of hay and roots in winter and pasture in summer. Special attention should be paid to the improvement of hay-production, so that a heavy, and also cheap, crop may be forthcoming. When hay can be produced, as it is on several farms in Sweden, at 25 to 32s per ton, it forms a cheap feed, even when used in large quantities.

Pasturage is the cheapest food, in relation to production, that there is, as modern Swedish pasture farming also demonstrates. Since pasture farming on a large scale considerably diminishes the farmer's labour-bill, and provides him with the greatest possible quantity of foodstuff per unit of area (1), the writer recommends Swedish farmers to make use of the advantages of modern pasture farming. The first step in this direction is the improvement of great areas of natural pasture. It is to be noted that only such areas as are not very well suited for growing cereals should be used for this purpose, or at least only so much of the better land as circumstances may demand : for example, if young stock is to be raised and there is no other land available, or where pasture for dairy cattle is required close to the homestead. Pasture farming on a large scale should not be allowed to interfere with the output of cereals.

The preliminary conditions necessary to make permanent pastures pay are present in Sweden. For land is cheap and the distribution of the rainfall is favorable ; most rain falls in late summer, when the pastures are most sensitive to drought. Our light nights, and the fact that the energy of growth increases as the northern frontier is approached, make the production decidedly large in proportion to the length of the growing period.

In laying down permanent pastures, especial attention must be paid to manuring. For sowing in a bleak climate, the seed must be of varieties which stand the winter well. These are not usually in stock on the seed markets, but they grow wild everywhere in northern countries, and include, for example, meadow fescue, red fescue, smooth-stalked meadow-grass, rough-stalked meadow-grass, foxtail, etc. A firm seed-bed and a heavy seeding are essential conditions for the success of the pasture.

The dressing of manure should be :

8 to 16 cwt. lime
2 ½ to 3 ¼ cwt. superphosphate or 5 to 7 cwt. basic slag
5 to 6 ½ cwt. kainit
} every three years.

Heavy and dry soils should get as much manure supplying humus as possible ; nitrogen should be given according to requirements : the quantity used in these parts is about ½ cwt. of nitrate of soda and sulphate of ammonia an acre a year.

The results so far obtained in Sweden are satisfactory. At Vallinge, in Södermanland, Hr. Kleen obtained 1200 food-units (2) an acre at a cost of production of £3 5*s*, including all expenses. This works out at two thirds of a penny per food-unit. If foodstuffs have to be purchased, the cost of production rises to at least twice as much.

(1) Experiments in Denmark show that grass mown 6 times (e. g. Cocksfoot) gives a lighter crop of hay, but a larger amount of digestible foodstuff, than when mown only twice. ("Om Vaeksten af Hundegräs och Draphavre", etc., by E. LINHARD, in *Tidskrift för Landbrugets Pianteavl*).

(2) A food-unit is equal to about 1.33 lb. of starch value.

The daily increase in live-weight of young stock amounts to 600 to 700 gms. (20 to 25 oz.) per head. At Latorp, where the mean rainfall is 13.7 in. for the six months April to September the increase per head per day exceeded 900 gms. (2 lbs.).

On the experimental farm of the Swedish Moor Cultivation Society at Flahult, near Jönköping, excellent results have also been obtained from peat soils, with a net profit of over £2 4s per acre.

In Central Sweden the pasturage period lasts about 150 days, that is about the same as in Germany.

732 – ***Beckmannia erucaeformis* Host., a New Grass for Moor Meadows.** — WITTMACK, L. (Berlin) in *Mitteilungen der Deutschen Landwirtschafts-Gesellschaft*, Year XXIX, Nos. 22 and 24, pp. 309-312 and 356, + 3 plates. Berlin, May 30 and June 13, 1914.

The writers gives a description of *Beckmannia erucaeformis* Host.; this grass has also been referred to *Phalaris* (Linnaeus) and *Cynosurus* (Aiton and Willdenow), but is now made the only representative of the genus *Beckmannia*.

This species is found in Italy, Hungary, S. E. and E. Europe, N. and C. Asia, and in America from Alaska to Minnesota ; several varieties have been described. It occurs along rivers and in swamps, in Russia also in saline marshes. In Germany it has been introduced here and there.

There is little information as to its feeding value. In Russia, where it has already been grown on a large scale in some places, it is considered useful, though giving a rather coarse hay. It appears to resist frosts and fungi, and grows very tall. The abundance of salts characteristic of most of its stations in Russia does not seem to be essential. The production of seed is abundant, in spite of its perennial character ; the trade " seed " consists of the whole spikelets.

733 – **A Fodder for the Dry Season: *Tripsacum fasciculatum* Trinius.** — PEDROSO, A. in *Journal d'Agriculture Tropicale*, Year 14, No. 155, pp. 137-138. Paris, May 31, 1914.

Trials have been carried out in Costa Rica with *Tripsacum fasciculatum* Trinius, a perennial grass somewhat similar to sugarcane in appearance. It may reach a height of more than 16 ft., produces adventitious roots and continues to vegetate almost indefinitely. Cattle eat it readily, horses rather less willingly and then only the leaves or the young stems cut up. The special advantage of *Tripsacum* is that it remains green during the dry season and yields good crops even on poor soil.

Propagation takes place by means of slips which are set about 3 ½ in. deep and 20 in. apart. For the first six months after planting the land must be kept hoed and free from weeds. Four cuts per annum are obtained, the last of which should take place at least one month before the end of the rainy season in order that the plant should be sufficiently recovered to stand the subsequent drought.

734 – **African *Bombax*.** — VUILLET, J. in *L'Agronomie coloniale*, Year I, No. 10, pp. 97-105. Paris, April 30, 1914. FIBRE CROPS

The existence of numerous natural hybrids makes it frequently very difficult to identify the various species and varieties of *Bombax ;* moreover complete specimens of the trees are not easy to obtain, as they only flower after the leaves have fallen, and the new shoots do not appear till after the fruits have dropped. The writer distinguishes four *Bombax* in the Nigerian Soudan :

1. *B. with ribbed fruits.* — The ovary has five well marked furrows on its upper half, which alternate with the lines corresponding to the valvular sutures in the fruit and form a five-toothed crown at the top ; the capsule has five deep inter-sutural furrows clearly defined in the upper half ; the seeds are sub-spherical instead of pyriform.

2. *B. with papillose fruits* — Calyx not very villous and only half the length of the flower instead of two-thirds ; capsules slightly papillose.

3. *B. with long fruits* — Calyx always longer than half its diameter and showing a very irregular edge when burst by the opening flower; ovary longer than in other species (6 to 7 mm. in diameter at the base by 10 mm. long) and not concave at the top ; fruits sub-cylindrical and drawn out in the shape of a sausage.

4. *B. with yellow flowers.* — Leaves usually made up of five leaflets, thicker and forming a more obtuse angle at the base than other Soudan species ; flowers yellow or yellowish-green on the outer surface of the petals, brighter yellow on the inside; fruits slightly furrowed at the base and having small ridges in the upper half.

735 – **The Oil Palm *(Elaeis guineensis).*** — BECCARI, ODOARDO in *L'Agricultura coloniale*, Year VIII, Nos. 1-4, pp. 5, 108, 201, 255. Florence, January-April 1914. CROPS YIELDING OILS DYES AND TANNINS

The writer discusses the work of ADAM and of CHEVALIER on *Elaeis* and draws up the following classification of the oil palms to serve as a basis in selecting and breeding new varieties for cultivation. He also describes a new variety, *E. guineensis macrocarya* Becc., with remarkably large fruits, the nut of which varies in weight from 23 gm. to 54 gm. (1 to 2 oz.) and may measure up to 50 × 43 mm. ; the shell of the nut is very thick and the kernel is small and irregular in shape ; the albumen has a rather large central cavity and the albumen tissue is made up of larger cells than that of any other variety and contains a larger number of crystalloids.

Classification of Elaeis.

Species	Varieties	Previously called :
E. guineensis Jacq.	*angulosa* Becc.	"Ökpörö Eyop", Bull. Misc. Inf. Kew, 1909, No. 2.
	albescens Becc.	"Abefita", Bull. Misc. Inf. Kew, 1909, No. 2.
	communis Aug. Chev.	—
	form *androgina* Aug. Chev.	—
	» *divisa* Aug. Chev.	—
	» *ramosa* Aug. Chev.	—
	sub. var. *dura* Becc.	*E. nigrescens* (typ. Aug Chev. Documents, p. 47
	» *fatua* Becc.	"Abe-dam" Bull. Misc. Inf. Kew, 1909, No. 2.
	» *leucocarpa* Becc.	*E. nigrescens communis* (*vulgaris*) Aug. Chev. Doc. p. 50.
	» *semidura* Becc.	"Abe-tuntun", Bull. Misc. Inf. Kew, 1909, No. 2.
	» *tenera* Becc.	*E. nigrescens communis* Aug. Chev., Doc., p. 49.
	gracilinux Aug. Chev.	—
	idolatrica Aug. Chev.	—
	intermedia Aug. Chev.	—
	macrocarpa Aug. Chev.	—
	macrophylla Aug. Chev.	—
	pisifera Aug. Chev.	—
	repanda Aug. Chev.	—
	rostrata Becc.	"Mbana Eop", Bull. Misc. Inf. Kew, 1909, No. 2.
	macrocarya Becc.	
E. madagascariensis Becc.		*E. guineensis* var. *madagascariensis* Jum. et Perrier de la Bâthie.
E. melanococca Gaertn.		—

RUBBER, GUM AND RESIN PLANTS

736 – **Manuring Experiments with Hevea.** — DE JONG, W. K. in *Teysmannia*. Year XXIII, No. 3, pp. 133-144. Batavia, 1914.

An account of manurial experiments carried out on 80 trees aged 7 to 7 ½ years.

737 – **Tapping Trials with *Funtumia elastica* in the Belgian Congo.** — GISSELAIRE, A. in *Bulletin agricole du Congo belge*, Vol. V, No. 1, pp. 95-104. Brussels, March 1914.

Tapping experiments were carried out in the Bangala district on trees 7 to 9 years old. The tapping was done in the early morning, being finished at half-past eight or nine at the latest; herring-bone incisions were employed, single or double according to the size of the trunk, all trees of over 20 in. circumference at 3 ft. from the soil receiving the double incision ; lateral incisions were 10 in. from the central incisions and large trees were tapped to a height of 16 ft. Coagulation was brought about by boiling water.

The following results were obtained at Musa : 1696 trees yielded 75 gallons of latex from which 375 lbs. of raw rubber were coagulated, or 3.6 oz. per tree including scrap. As the trees can probably be tapped twice a year this quantity should be doubled to estimate the annual production.

At Katu, 1368 *Funtumia* yielded 67 gallons of latex from which 345 lbs. of raw rubber were obtained, or 4.3 oz. per tree including scrap. The rubber lost 23 per cent. on drying so that 3.3 oz. of dry rubber were obtained per tree or 6.6 oz. per tree per annum, and one acre planted 10 ft. apart would yield 200 lbs. of dry rubber per annum.

Samples from both localities were submitted to experts, who reported favourably on their quality and estimated their value as equal to that of plantation hevea.

738 – **The Nipa Palm (1) as a Commercial Source of Sugar.** — PRATT, D. S., THURLOW, L. W., WILLIAMS, R. R., and GIBBS, H. D., in *The Philippine Journal of Science*, Vol. VIII, Section A, No. 6, pp. 377-398. Manila, December 1913.

SUGAR CROPS

The nipa palm (*Nipa fruticans* Wurmb.) covers large tracts of land in the Philippines which amount to 18 000 hectares (45 000 acres) in the provinces of Bulacan and Pampanga alone. Up to the present the sap exuded by the flower stalk has only been utilized on a large scale as a commercial source of alcohol; it was examined by the writers with regard to the possibility of extracting the sugar contained.

The yield amounts to about 40 litres (9 ½ gallons) of sap per season of 150 days per annum, or, with 750 trees per hectare, to 30 000 litres per hectare (2650 galls. per acre) per annum, the maximum flow occurring during the second month. As it flows from the palm the sap contains about 15 per cent. of saccharose and has an apparent purity of not less than 85, only traces of invert sugar being present; the addition of about 0.5 per cent. of sodium chloride slightly reduces the purity without lowering the extraction of sugar as it is classed among the non-melassigenic salts; waxes, acids, pectins and other foreign materials are practically absent ; the sap contains active enzymes of the invertase and peroxidase types, the latter being present only during the final period of secretion and being capable of oxidizing sucrose and invert sugar in either neutral or alkaline solution.

(1) See No. 2884, *B.* Aug.-Sep.-Oct. 1911 and No. 604, *B.* May 1913. (*Ed.*).

The sap is usually collected in bamboo tubes known as "tuquils", containing a little milk of lime and sulphite, which destroy the enzymes and avoid the necessity of subsequent bleaching ; the use of small funnels to convey the juice to the bottom of the tuquils avoids stratification and results in more perfect conservation with but small additional expense. The total cost of collecting the sap and delivering it to the mill amounts to $1.50 per 1000 litres (2*s* 9*d* per 100 galls.).

A thousand litres of sap yield on an average 115 kg. of commercial white sugar polarising at from 99° to 99.5°. No important modification of methods now used in sugar practise is necessary in dealing with nipa juice ; furthermore, no expense corresponding to the grinding of cane or the extraction of beets need be incurred, while the fuel supplied by the bagasse may be easily substituted by the cheap and plentiful wood of mangrove swamps.

As about 9 000 litres of sap are required to produce 1 ton of 96° sugar, 90 000 litres daily would be required to run a 10 ton mill at full capacity, that is the produce of 450 hectares. A mill designed to manufacture sugar from nipa juice would be available for refining Philippine sugar during that portion of the year when no sap is flowing, a process in which there is a reasonable profit. All estimates are conservative and there is every indication of the establishment of a successful industry.

The Bureau of Science (Manila) will gladly furnish samples of nipa sugar to any one interested.

739 – **Analysis of Sugar-Beets.** — PELLET, H. in *Sucrerie Indigène et Coloniale*, Vol. LXXXIII, Nos. 19 and 20, pp. 441-446 and 466-471. Paris, May 13 and 20, 1914.

As the result of a long series of analyses, the writer concludes that there is no relation between the size of sugar-beets and their sugar content.

STIMULANT, AROMATIC, NARCOTIC AND MEDICINAL CROPS

740 – **The Cultivation of Cacao in Trinidad and the Gold Coast.** — FREEMAN, W. G. in *Bulletin of the Department of Agriculture, Trinidad and Tobago*, Vol. XIII, No. 79, pp. 75-83. Trinidad, March-April 1914.

A reply to an article in the *Philippine Agricultural Review* attributing the recent decline in the exports of Cacao from Trinidad to bad cultural practices, overshading of trees and severe fungus disease.

The writer points out that this decline corresponds to seasons of abnormally low rainfall and gives figures showing a considerable improvement in the production of cacao during 1913 corresponding to an improvement in the climatic conditions. Reference is also made to reports of the Gold Coast Department of Agriculture showing that the remarkable increase in the exports of cacao from West Africa is due to the natural advantages of suitable areas and cheap labour, rather than to the application of scientific horticultural methods.

741 – **Manurial Experiments with Tobacco.** — VRIES, O. in *Proefstation voor Vorstenlandsche Tabak, Mededeeling* No. IX, pp. 42. Amsterdam.

Manurial trials with tobacco were carried out on poor soils in Java during the years 1912 and 1913, with the object of determining the effect of the fertilizers on the quality of the tobacco.

The following results were obtained : on the " brown " soils potash had little effect on the quality of tobacco, while superphosphate injured its combustibility without spoiling the colour of the ash ; on the blue clay and sandy soils potash was again without action, while superphosphate sometimes proved beneficial and sometimes harmful both to the combustibility and to the colour of the ash. Sulphate of ammonia had no harmful effects and occasionally affected the quality beneficially ; its use is therefore advocated, as it always increases the yield.

742 – **Experiments in Harvesting Tobacco Leaves.** — De Vries, O. in *Proefstation voor Vorstenlandsche Tabak, Mededeeling* No. VIII, pp. 43. Amsterdam.

Experiments on methods of harvesting tobacco leaves were carried out during 1912 and 1913 in Java. It is recommended that all picking should be done in the early part of the day and that leaves from the lower parts of the plants should be picked singly, except in wet years, when it would probably be better to pick the whole plant at once, for in that case the over-maturity of the lower leaves would be an advantage during the curing process.

MARKET GARDENING

743 – **The Market-Gardening Districts of Northern Germany.** — Weirup, in *Arbeiten der Deutschen Landwirtschafts-Gesellschaft*, No. 250, pp. 1-40. Berlin, 1913.

The above publication is a report of the horticultural conditions in the Luneburg district, in the Hamburg district and in West Holstein presented to the " Deutsche Landwirtschafts-Gesellschaft ". These districts are partly under fruit trees and partly under early potatoes, strawberries, rhubard and vegetables. The chief markets are Hamburg and Altona, but at the present time these outlets are not sufficient to deal with all the cabbages produced, and the marketing conditions generally should be improved. The large market at Hamburg with its store rooms is specially described, also the premises of the " Fruchthandel-Gesellschaft " of Bremen, which organises the supplies of fresh market-garden produce not only from the local districts but also from more distant ones.

FRUIT GROWING

744 – **Fruit Growing in Australia.** — Hattrick, J. M. in *Deutsche Obstbauzeitung*, No. 11, pp. 231-244. Stuttgart, June 1, 1914.

The rural population of Australia is small as compared with the urban population — the total population only amounting to five millions — and of

Table I. — *Distribution of surface (acres).*

	Total area	Total area cultivated	Under cereals	Vineyards	Fruit plantations
Western Australia	624 588 800	855 023	648 801	2 795	16 737
South Australia	243 244 800	4 141 992	2 228 482	22 952	22 411
Victoria	56 245 760	5 386 247	2 877 315	23 412	57 375
Tasmania	16 777 600	5 380 971	142 666	—	24 919
New South Wales	198 054 400	3 381 920	2 436 050	8 036	47 354
Queensland	431 120 000	935 021	295 801	1 633	17 466
New Zealand	67 040 600	16 265 889	692 565	781	31 952

TABLE II. — *Area under the different kinds of fruit, in acres.*

Kind of fruit	Western Australia	South Australia	Victoria	Tasmania	New South Wales	Queensland	Total
Hard fruit:							
Apples	9 956	10 183	22 164	22 678	11 165	1 238	77 384
Pears	1 211	996	6 338	—	2 590	54	11 189
Quinces	—	—	810	—	531	8	1 349
Stone fruit:							
Apricots	521	1 735	2 441	—	880	47	5 624
Cherries	—	838	2 755	—	1 532	30	5 155
Peaches	1 352	1 710	4 095	—	7 006	615	14 778
Plums	823	1 349	4 903	—	1 411	210	8 696
Nectarines	—	—	59	—	—	45	104
Persimmons	—	—	5	—	141	15	161
Nuts:							
Coconuts	—	—	—	—	—	237	237
Hazel nuts	—	—	400	—	—	—	400
Almonds	—	2 778	260	—	—	2	3 040
Walnuts	—	—	800	—	—	—	800
Citrus fruits:							
Oranges	1 026	2 014	860	—	14 468	3 450	21 818
Lemons	220	553	680	—	3 680	47	5 180
Tangerines	—	—	—	—	4 643	—	4 643
Other fruits (*tropical, etc.*)							
Pineapples	—	—	—	—	—	2 417	2 417
Figs	600	—	440	—	—	15	1 055
Bananas	326	—	—	—	—	6 462	6 788
Custard-apples	—	—	—	—	—	50	50
Loquats	—	—	64	—	—	—	64
Papaws	—	—	—	—	—	185	185
Passion fruit	—	—	50	—	57	12	119
Breadfruit	—	—	—	—	—	366	366
Small fruit	714	272	6 240	—	126	808	8 160
Unclassified	—	—	—	4 238	—	—	4 238
Total	16 748	22 428	53 364	26 916	48 230	16 313	184 000

TABLE III. — *Average yields of fruit per tree, lbs.*

Kind of fruit	Queensland	N. S. W.	Victoria	S. Australia	W. Australia	Tasmania
Apple	22	45	46	30	26	29
Orange	81	49	66	44	27	—
Peach	—	46	52	26	27	—
Pear	—	57	88	56	43	—
Plum	—	65	51	45	—	—
Apricot	34 to 38 throughout Australia					
Cherry	21 to 28 » »					
Lemon	—	53	—	—	—	—
Tangerine	—	51	—	—	—	—
Almond	—	—	—	2½	—	—
Banana	178 bunches p. acre					
Pineapple	318 doz. fruits »					

the rural population only a small part grow fruit. Yet the area under fruit is already considerable in spite of the industry being still in its infancy. Table I gives the distribution of the area in 1911 in Australia and New Zealand.

In every State except South Australia the area under vineyards is smaller than that under fruit trees ; the latter has increased at the rate of about 4500 acres per annum for the last ten years in Australia and New Zealand.

Kinds of fruit. — The climate being well adapted to fruit growing, especially in the coastal regions (S. Queensland), most kinds flourish ; the distribution of the various kinds is given in Table II.

There are no available data for New Zealand and it is pointed out that as different methods of collecting the returns are employed in the various States, the figures are only approximate.

The most important Australian fruit is the apple, followed at a distance by orange, peach, pear, plum, and small fruit. Queensland produces the tropical fruits (oranges, bananas and pineapples), New South Wales grows citrus fruit more especially, but peaches, apples and pears also flourish there ; in Victoria, the so-called " Orchard State ", the fruits of temperate climates (apples, pears, etc.) predominate, though citrus fruits do well in the northern part ; Tasmania is above all the apple orchard of Australia ; South Australia grows more especially apples and almonds ; and lastly Western Australia grows apples.

Average yields. — Average yields for each kind of fruit are obtained by dividing the official returns of production for each State by the number of trees in that State. The resulting figures are sometimes very low ; in certain parts, especially in Western Australia, the area under fruit trees

has been more than doubled during the last seven years, with the result that many of the orchards are very young and yielding small crops ; besides this, many orchards are planted in unsuitable places by inexpert townspeople and the poor returns from such orchards reduce the average yield for the State. In Table III are set out the average yields of various fruits in each State.

The average yield for apples varies from 22 lbs. to 46 lbs., being lowest in Queensland and highest in Victoria and New South Wales ; the yield in Tasmania is depressed by the fact that the trees are planted too close together in some of the old orchards ; Western Australia only averages 26 lbs. in spite of her eminently suitable climate.

Varieties grown. — Owing to the variable climatic conditions met with in the various States, the varieties grown are very numerous.

Apples (classed in order of importance).

Maiden's Blush, Duke of Clarence, Pomme de Neige (early, exported to Great Britain)
* Bismarck
King of the Pippins
Cox's Orange Pippin
Scarlet Nonpareil (late)
* Cleopatra (mid-season).
Jonathan.
Sturmer's Pippin.
French Crab (late).
Dumelow.
London Pippin or
Three-crowned Pippin.
Lane's Prince Albert (mid-season).
Statesman.
Lord Suffolk (early).
* Stetwarts (late).
Gravensteiner (mid-season).
Rome Beauty (late).
Esopus Spitzenberg (late).
Peasgood Nonsuch (early).
Wealthy (mid-season).
Shepherds' Perfection (mid-season).
Stone Pippin (late).
Rymer (late).
Schroeder (late).
Winter Strawberry (late).
* Rokewood (very late, keeps well in cold storage).
Shorland Queen (early).
Canada Pippin (mid-season).
Yates.
Kaiser Alexander.
Newmann's Seedling (late).
Green Alfriston (early).
* Granny Smith.
* Carrington (early).
* Trivett (early, resistant to blight and a heavy cropper).
Mc Intosh Red (early).
Twenty Ounce Pippin.
Warner's King (early).
Beauty of Bath (early).
Lady Daly.
* Dunn's Favourite or Munroe's Favourite.

Pears.

Clapp's Favourite.
William's Bonchrétien.
Beurré Superfin.
Box's Bottling Pear.
Beurré Diel.
Winter Beurré d'Hardepont.
Doyenne du Comice.
* Winter Cole.
Beurré Curé.
Josephine de Maline.

* Of Australian origin.

Winter Nelis.
Tongre.
* Packhams' Triumph.
Beurré d'Anjou.
Conference.
Howell.
Madame Cole (late).
Keiffer (mid-season).
Broom Park (late).
Anna Nelis.
Autumn Beurré Coloma.

Quinces.

Apple Shaped.
Rea's Mammoth.
Portugal.
Pear Shaped.
Master's Early.

Apricots.

Royal.
Moorpark.
Tilton.
Mansfield's Seedling.
Hemskirke.
Shipley's Blenheim.
Peach.
Large Orange.
Alsace.

Cherries (on wild Mazzard stock).

* Troyford- Hart (best of the earlies).
Napoleon.
Black Republican.
Claremont.
Early Lyons.
Florence.
Noble.
St. Margaret.

Peaches.

Champion.
Lady Ingold.
Admiral Dewey.
Foster.
Kia Ora.
Riverside Elberta.
California.
Comet.
Globe.
Wiggins.
Nicholls Orange Cling.
Philip Cling.
Pullar's Cling.
Brigges Red May.
Early Albert.
Early Louise.
Elberta.
Hains Early.
Mountain Rose.

Plums.

Angelina Burdett.
Belgian Purple.
Belle de Septembre.
Burbank.
Kelsey.
Kirkes.
Coe's Golden Drop.
Pond's Seedling.
De Montfort.
Prince Englebert.
Purple Gage.
Washington.
Clyman.
Denniston's Superb.
Diamond.
Diaprée Rouge.
Early Orleans.
Evans Early.
Green Gage.
Jodoigne Green Gage.

October Green Gage.
Oullins Golden Gage.
Princess Alexandre.
The Czar.
Denbigh.
Deneyer's Victoria.
Grand Duke.
Imperiale de Milan.
Jefferson.
Late Black Orleans.
Magum Bonum (white and red).
Monarch.
Pond's Seedling.

Almonds.

Brandes Jordan.
Nonpareil.
Paper Shell.
Sultana.

Walnuts.

Dwarf Profilic.
Santa Barbara.

Tangerines.

Emperor.
Thorny.
Beauty of Glen Retreat.
Parke's Special.
Canton.
Scarlet.

Oranges.

Washington Navel.
Joppa.
Parramatta.
White Siletta.
Late Valencia.
Thompson's Selected.
Paterson's Seedling.

Lemons.

Lisbon.
Lisbon Thornless.
Sweet Rind.
Villa Franca.
Genoa.

Bananas.

Cavendish.
Lady's Finger.
Plantain.
Sapientum.
Giant Sugar.

Figs.

Adam.
Blue Provence.
Angelique Bordeaux.
Black Turkey.
Brown Turkey.
Black Genoa.
Brown Ischia.
Blue Ischia.

Red and White Currants.

Cherry.
La Fertile.
La Versaillaise.
Red Dutch.
Mammoth.
Red Imperial.
White Dutch.
White Transparent.
White Imperial.

Black Currants.

Black Naples.
Carter's Black.
Champion.
Kentish Hero.
Lee's Prolific.
Ogden's Black Grape.

Gooseberries.

Red:

Billy Dean.
Crown Bob.
Ploughboy.
Prince Regent.
Conquering Hero.
Jolly Miner.
Keen's Seedling.
Overall.
Roaring Lion.
Lancashire Hero.
Lion's Provider.

White:

Gill's Seedling.
Northern Hero.
White Muslin.
Thumper.
Waterloo.
Plunder.
Smiling Beauty.
Whitesmith.
White Lion.
White Eagle.

Green:

Drill.
General Graham.
Gretna Green.
Green Gascoique.
Greenwood.
Green Overall.
Heart of Oak
Keepsake.
Lord Crewe.
Nelson.
Peacock.

Yellow:

Dublin.
Goldfinder.
High Sheriff.
Leader.
Leveller.
Pretty Boy.
Rockwood.
Sulphur.
Trumpeter.
Yellow Lion.

Raspberries.

Antwerp Red.
Antwerp White.
Falstaff.
Northumberland Fillbasket.
Victoria.
Cuthbert.
Franconia.
Golden Queen.

Strawberries.

Annetta.
Aurie.
British Queen.
Captain.
Crescent Seedling.
Dr. More.
Melba.
Laxton's Noble.
Phenomenal.
Sir Harry Rawson.
Federation.
Glenfield Beauty.
Governor General.
Howcroft.
King Edward VII.
Marguerite.
Marshall.
Zena.
Lord Kitchener.
Trollope's Victoria.
Creswell.

Planting Fruit Trees. — Land may always be obtained from the Government on very favourable terms for the purpose of planting fruit, provided that the holder builds a house and lives on the land. Usually payment is made in twenty small annual instalments. Such land always consists of unbroken bush or forest, so that the formation of an orchard is a laborious matter ; felled timber is unsaleable and has to be burned on the spot. Young trees are provided by the large Australian nurseries ; they usually consist of pure varieties and are planted on the square or the quincunx method at the rate of 90 to 100 trees per acre. Trees come into bearing very early owing to the warm climate : apples, for instance, yield fair crops at five or six years old.

Cultivations. — The hot climate and the summer droughts, occurring just at fruiting time and lasting three, four, or even six months, necessitate repeated cultivations, which on the other hand are limited by the scarcity of labour. Immediately after the fruit has been gathered, the soil is ploughed deeply in order to absorb as much water as possible during the winter. A second ploughing is usually given at the end of July or beginning of August to destroy weeds, and during the summer the surface is kept stirred to prevent evaporation.

Manuring. — Most of the land under fruit is sufficiently fertile not to require manuring, but fruit has also been planted on some poorer soils where it soon became evident that the trees were being starved and consequently manuring had to be resorted to. Farmyard manure is rarely available, as the farmers only possess the bare number of horses required to work the holding and these are not often in the stable. In the neighbourhood of towns where it may be bought cheaply , dung is frequently employed ; in other parts it is replaced by green manuring to make good the loss of humus, which decomposes rapidly owing to the hot climate. Green crops are only grown during the winter, as their drying effect would be bad during the summer ; they consist almost entirely of leguminous crops, which do well in the cool winter months. Peas and vetches are chiefly employed ; the orchard is cultivated in autumn (February-March) as soon as the fruit crop has been harvested, and seed is sown in April ; in August the green crop flowers and is ploughed in. A few growers use forest leaf mould instead of a green crop where shallow cultivations are employed in order not to injure the roots of the fruit trees. Artificial manures are also in common use, especially bone flour or other phosphatic manures, because the soils while very rich in potash are exceptionally poor in phosphoric acid ; a more complete manuring is becoming usual.

Irrigation. — Good returns are obtained by irrigating fruit orchards in Australia, and a fair proportion of the land under fruit is irrigated in spite of the undeveloped state of the country :

New South Waies	1 000 acres
Victoria	17 550 »
South Australia	3 600 »
Total	22 150 »

Victoria is justly called the Australian Irrigation State, though New South Wales completed in July 1913 a colossal dam which is to hold up almost as much water as the Assuan dam in Egypt, and to help to bring 40 000 acres under irrigation by means of a canal 240 miles long. At the present moment the Mildura district, Victoria (6 500 inhabitants), is the most important irrigation area. It is situated on the Murray and extends over 9 700 acres, having been founded in 1887 by the Chaffey Bros., who received large grants of land in Victoria and undertook to construct an irrigation system. At present the land is occupied by small holders ; the holdings vary in size from 10 to 40 acres and the right to water goes with the land. Four pumps with a total capacity of 22 million gallons per minute raise the water 50 to 90 ft. above the level of the river ; the irrigation works are administered by a committee elected from amongst the holders, which levies the water rate and regulates the distribution of the water ; rates vary from 10s to £2 per acre. The pumps usually work for about 120 days per annum, providing one watering in winter, two following close on one another in the summer, and one in the autumn. The chief crops at Mildura are raisins, lemons and peaches.

Another important irrigation scheme, in this case belonging to the State of Victoria, is situated in the valley of the Goulburn, where reservoirs have already been constructed to hold 60 000 million gallons ; others are planned to raise the total storage capacity to 360 000 million gallons, which will be sufficient to irrigate 750 000 acres. Small irrigation plants in the Doncaster district should also be noted ; almost every holder has a tank at the top of his orchard into which water is pumped by means of a windmill or a petrol engine and from which the water is led in channels to all parts of the holding. The chief irrigation scheme in South Australia is at Renmarck, also on the Murray and on the same principle as Mildura, but of about one-third the size of the latter.

Management of trees. — Usually half-standards are planted; four to five or even nine main branches are trained in a cup shape, the centre of the tree being kept as open as possible; all secondary branches are kept short so that the fruit is formed close to the main branches which is said to facilitate the feeding of the fruit. Pruning varies with the different varieties, but the writer is inclined to think that it is always somewhat excessive, except in the case of lemon trees, where only the dead wood is cut out.

Enemies and their control. — Codling moth (*Carpocapsa pomonella*) causes serious damage to apples; lead arsenate washes are used against it as well as grease bands. American blight (*Schizoneura lanigera*) is also very prevalent ; it is checked by means of paraffin emulsion washes. A desease known as " bitter pit " causes serious harm and is being investigated at the present time. Other parasites frequently met with are: red spider (*Tetranychus telarius*), San Jose scale (*Aspidiotus perniciosus*), peach leaf curl (*Exoascus deformans*), *Clasterosporium carpophilum*. Certain preventive measures are prescribed by law.

Fruit Trade. — All small fruit, as well as a large part of the citrus fruit, finds a market in the Australian towns. Apples, lemons and dried fruits

find an Australian market at certain times of the year but are also important export products, more especially in the case of apples ; the development and extent of the apple trade is given in Table IV.

TABLE IV. — *Exports of apples in tons.*

State	1910	1911	1912
Western Australia.	198	281	1 163
South Australia	2 335	1 258	3 369
Victoria	2 935	5 303	5 447
Tasmania	10 320	12 824	14 669
New South Wales.	250	136	306
Total . . .	16 038	19 801	24 954

Apples are mostly sent to Great Britain, but also to Germany (about 180 000 barrels in 1912), the Far East, South Africa and South America. In the modern orchards only those varieties are grown which are suitable for export. The production is continually increasing so that it is constantly sought to improve the existing markets and to find new ones, a matter which should not prove difficult as the apples are of excellent quality and arrive in Europe from March to May, at a season when the home crop is already consumed ; they consequently fetch good prices.

While the organisation of the export trade is excellent, that of the home trade is poor, especially with regard to marketing, so that the producers are sometimes completely in the hands of the town retail dealers and it frequently occurs that producers receive very little for their crops when the consumers are paying a high price.

Cost of planting and production. — Conditions are so variable that the data can only be given approximately. The cost of buying the land, clearing, cultivating, fencing, planting and management up to the time the trees are in full bearing is estimated at from £75 to £100 per acre. A twelve-year-old apple orchard should bring in £20 per acre per annum.

745 – **South American Fruit.** — *Boletin de la Union Panamericana*, Vol. XXXVIII, No. 3, pp. 318-335. Washington, March 1914.

The writer describes the general conditions of fruit growing in South America and the possible developments of the industry in view of the variations of climate met with in the different parts of the continent and of the new transport facilities afforded by the opening of the Panama Canal. He points out the difference between fruit growing in North America, where deciduous trees prevail, and in South America, where the tropical and subtropical fruits are more general and native apples, pears, peaches and plums do not exist. Native fruits of South America are as follows :

Guava (*Psidium Guaiava*).
Custard apple (*Anona Cherimolia*).
Passion fruit (*Passiflora edulis*).
Spondias dulcis.
Prickly pear (*Opuntia* sp.)
Gomortega nitida Queule.
Murta murtella (*Myrtus Ugni* Molina), with berries very like the blueberry (*Vaccinium*).
Miqui (*Aristotelia Macqui*), sometimes mixed with grapes in the manufacture of wine.
Grapes, an unimportant variety found in the extreme north.
Capuili or Capoilles (*Prunus salicifolia*), rather like the American wild cherry.
A few other kinds which are little known.

Very few of these fruits are given in the American Pomology and many are of little commercial importance, but there is every reason to believe that the usual commercial kinds can also be produced as many have already been successfully introduced: for example sapotas, mangoes, bread fruits, tamarinds, pomegranates, avocados (*Persea gratissima*), olives, figs, citrus fruits, are grown in sub-tropical regions, while the ordinary fruits of the United States are grown in the temperate regions.

In the Argentine the vine is the only fruit cultivated on a large scale, the vast plains of the region being little adapted to fruit growing; nevertheless, in the pampas, and especially in the neighbourhood of Buenos Ayres, some attention is now being paid to the matter. The so-called Tigre Islands at the mouth of the Paraña are famous for their peaches. Around Tucuman citrus fruits, especially oranges, are cultivated and the industry might well be developed with improved means of transport and better methods of packing. Regions in the province of Salta are well adapted to sub-tropical fruits, such as the custard apple and avocado, which are as yet only produced for local consumption. In the provinces of Neuquen and Rio Negro some wild apples occur, which, according to tradition, are descended from trees imported by the Jesuits and which still yield fruit of good quality. But the vine is the only fruit possessing any real commercial importance in Argentine at the present day; of late years its cultivation has greatly increased and proved very remunerative in the province of Mendoza; a well equipped school of viticulture has even been founded in Mendoza itself and is to be extended next year. The prosperity of the industry dates from the arrival in the district of some Italian vine growers. High quality table grapes are produced and the erection of a small refrigerating plant makes it seem likely that the Buenos Ayres market will soon be within reach. Other fruits cultivated on a small scale in the Mendoza and San Juan districts are peaches, nectarines, apricots and pears.

In Chili the general conditions are very similar to those prevailing in California and similar kinds and quality of fruit are produced, though the industry is much less developed in Chili; fruit of excellent quality and appearance is found on the markets of Valparaiso, Santiago and Concepcion. Between the Andes and Valparaiso, sub-tropical fruits such as avocado, custard-apple and papaya are found, though they are inferior in size and

quality to similar fruits produced in their native tropical habitat ; citrus fruits are cultivated in fairly large quantities in districts south of Santiago which are not subject to frosts, but are not abundant on the markets between January and April. As in the Argentine, grapes are the most important kind of fruit in Chili ; they are mostly employed for the manufacture of wines which are very popular in South America and are exported to Argentina in large quantities; the wine-growing region extends from Santiago to Concepcion. In the south very good pears and apples are cultivated; in fact the apples of Valdivia are renowned throughout Chili and important orchards are found near Angel, south of Concepcion. Further south is a wooded region rather similar to parts of the States of Oregon and Washington ; this southern region is frequently considered the most fertile in Chili, though very little has yet been done in the direction of bringing the land under cultivation except round Rio Buenos, where a German colony has completely transformed the neighbourhood.

Peru and Bolivia are quite in the tropical zone, though the altitude of certain regions modifies their climate. Those tropical fruits which are capable of resisting the somewhat primitive methods of transport are found on the Peruvian markets and are of excellent quality ; the grapes are good, but after transport are only fit for wine making ; from April to June, apples and peaches abound but these are not of first quality. Other fruits cultivated are oranges, bananas, avocados, custard-apples, sapota (to a height of 6500 ft.), guavas, "ciruela agria", "gravadilla" (*Passiflora ligularis*), "tumbo" (*Passiflora quadrangularis*), prickly pear (*Opuntia Tuna*) which is very abundant, and a kind of wild cherry with fruit about the size of Richmond cherries which is picked from wild trees in the Urubamba Valley (north of Cuzco) and marketed in May. The fertile soil and excellent climate in parts of both Peru and Bolivia should make it possible to increase the production of fruit very considerably ; it is at present much lower than it was several centuries ago before the Spanish occupation and the region only requires the restoration of the irrigation system in order to become once more productive. The period of ripening of the various fruits is as follows :

Apples. — March, or in rares cases January — February, to November.
Cherries. — November to February.
Peaches. — December to March.
Pears. — February to May.
Plums. — January to March.
Apricots. — December to February.
Grapes. — January to June.
Oranges. — September to December.
Lemons. — All the year round.

The fruits all mature at a time when the European and North American markets are without home supplies and would consequently fetch good prices; land is cheaper in South than in North America, irrigation water is abundant, labour is not costly, soils and climate are eminently suitable for fruit

growing; consequently it is likely that transport difficulties will soon be met and that the four countries discussed above are destined to become important producers of fruit.

746 – **Influence of Different American Vine Stocks upon the Quantity and Quality of the Wines.** — FAES, H. and PORCHET, F. *Etude de l'influence de divers Porte-greffes sur la Qualité et la Quantité de la récolte.* Station viticole de Lausanne, 46 pp. Lausanne, 1914.

The Lausanne Vine-growing Station possesses in several parts of the Canton of Vaud, nine experiment vineyards, each about two-thirds of an acre in extent ; they represent the most various conditions of soil and aspect; except for two which serve other purposes, each is divided into three portions. The first is planted with Chasselas Fendant grafted on various stocks ; the second with direct-bearers (white and red) about which the results obtained have not yet been published ; the third (which is kept as a check plot) is planted with European vines, especially Chasselas, on their own roots. The vines in these three portions are all of the same age, so that the influence of the stocks upon the wine can be freely studied in comparison with that produced by European vines upon their own roots. Each graft-bearing stock is represented by 80 or 100 specimens. The following have been tried : *Pure Americans* — Riparia Gloire de Montpellier and Rupestris du Lot ; *Americo-Americans* — Rip. × Rup. II F., Duforer, 101-14, 3309 and 3306, Sol. × Rip. 1616, Berl. × Rip. 420 A., 157-11, 34 E., Rip. × Cord. - Rup. 106-8 ; *Franco-Americans* — Aramon × Rup. 1, Mourvèdre × Rup. 1202 and Chasselas × Berl. 41 B.

The yield of each stock of grafted vines is carefully recorded and the must is examined chemically. The experiments were continued from 1911 to 1913. The most important results are summarized as follows :

Among the pure American vines, Rupestris du Lot in general appears inferior to Riparia Gloire. The vines grafted on Rup. du Lot yielded a higher crop, marked by a lower sugar content, while the amount of acidity was frequently rather high ; the quality and quantity were more satisfactory when the grafted vine was trained as a cordon (in one vineyard all the vines were thus treated). Rip. Gloire does not thrive equally well on all soils.

The group of Rip. × Rup. hybrids gave very uniform and good results and their yield was in general the highest of all stocks, the maximum being given by 3309 ; the next best was Rip. × Rup. 11 F., the third 101-14. In this group a normal connection between quality and quantity was observed, while Rup. du Lot, for instance, even with diminished quantity, yielded grapes of inferior quality.

Sol. × Rip. 1616 behaved very well during all three years. In two of the experimental vineyards it yielded the highest crops. The grapes in general are sweet and have a low acid content.

The vines grafted on Rip. × Berl. give, as is well known, a limited production during the first years ; this was very clearly shown in 1911 in comparison with the hybrids Rip. × Rup. Of the former, No. 157-11 was, during the three years, the most productive ; nevertheless the percentage of

sugar in the must was sufficient. In 1912 the difference in yield between the Berl. hybrids and those of Rip. × Rup. was already less marked and in 1913 the yield of the former approached still more that of the other stocks. Excepting in one experimental vineyard 34 E gave lower yields ; it was also less rich in sugar than 157-11. The writers do not yet pronounce definitively on the Teleki Rip. × Berl. hybrids, which were only recently planted.

Rip. × Cord. - Rup. 106-8 gave a satisfactory yield ; in 1911 it bore more than the Rip. × Berl. hybrids on the Franco-Americans.

In general the Franco-Americans during the three years, notwithstanding their vigorous development, yielded a crop lighter than and inferior in quality to that obtained by using as graft-bearers the less vigorous Rip. × Rup. hybrids. Aramon × Rupestris 1 and 1202 made no exception saving in two and one vineyards respectively, in which the compact and heavy soil seemed admirably suited to the Franco-Americans. But here also their yield did not come up to that of 3309. The sugar content in the grapes of these two common Franco-Americans did not show improvement in connection with the diminished quantity of yield. In comparing the two, it appears that 1202 often produced grapes with a higher acidity than Aramon × Rupestris 1. Stock 41 B behaved very differently in the various vineyards, as regards both quality and quantity; nevertheless in some it was fairly successful. Cabernet × Berlandieri (only recently planted in two vineyards) was not very productive and gave a must with too low a sugar content. The must of vines grafted on Vinifera × Rupestris 84-3, which were also only recently planted , showed in 1912 and 1913 a minimum of sugar and a maximum of acidity.

From the observations made it appears that in general (there are some exceptions) the content in sugar diminishes or increases inversely to the bulk of crop, while with acidity the reserve is the case.

747 – **Experiments in Growing Vine Hybrids in Styria.** — MATIASIC, FR. in *Zeitschrift für Weinbau und Weinbehandlung*, Year I, Part 5, pp. 209-218. Berlin, May 1914.

In Styria a great portion of the vineyards have been reconstituted (32 000 acres up to 1912) on American stocks ; in many localities, especially in the south, these suffer from chlorosis, so that some of the plantations gradually perish.

In order to ascertain which are the most suitable stocks for these difficult conditions, the soil often containing large quantities of lime, the Government established a nursery at Dvor in 1903 ; here the hybrid stocks recommended for calcareous soil are tested. This nursery consists of a plantation of stocks for multiplication, a nursery proper in which the cuttings, some of them grafted and some not, are set to root, and another nursery of stocks under observation in which the hybrids are tested as grafted stocks.

The soil of the nursery for multiplication purposes is partly on marl and partly stony and it contains from 63 to 72 per cent. of lime. The nursery is about 2 acres in extent and has 3301 mother plants belonging

to 45 varieties of hybrids. The writer divides these hybrids into three groups.

The first includes those which have always been free from chlorosis : Riparia-Cordifolia-Rupestris de Grasset 106-8, Berlandieri-Riparia 420 A, Aramon Ganzin 1 (it has to be defended against mildew), Chasselas-Berlandieri 41· B (it also has to be protected against mildew), Riparia-Monticola 1 R and Riparia-Rupestris. Their growth is very satisfactory (41 B is somewhat weaker) and the same may be said of the maturing of their canes ; they are not susceptible to drought.

The second group contains the hybrids that are not immune from chlorosis but which from other points of view are still fairly satisfactory : Solonis-Riparia 1616, Mourvèdre-Rupestris 1202, Solonis-Rupestris, Berlandieri-Riparia 420 B and C, 33 and 34 E. M., Riparia-Berlandieri Teleki 4, 5, 6, 7, 8 and 9, Riparia-Berlandieri 157-11, Rupestris-Solonis 215-1 and 217-1, Riparia-Berlandieri 150-15, Pinot-Rupestris 1305, Rupestris-Berlandieri 301 A, Malbec Berlandieri 1a, Taylor-Narbonne, Gamay-Couderc and Aramon-Riparia 143 B. The canes of all of them mature satisfactorily. Solonis-Rupestris and 1616 on their own roots at Dvor are not very resistant to phylloxera and consequently they are not to be considered as graft bearers. No. 1202, Gamay-Couderc, 1305, 143 B and 1 A suffer from mildew.

The third group embraces those hybrids which do not resist chlorosis, do not grow satisfactorily, or are somewhat susceptible to drought, and which consequently have been partly eliminated and replaced by better hybrids : Rupestris-Berlandieri 219 A, 220 A, 301 B and C, 301-37-152, Cabernet-Berlandieri 333, Cabernet-Rupestris 33 A (liable to mildew), Rupestris-Berlandieri Teleki 10 a, Riparia-Rupestris 3306-3309, 101 and 101-14, Colombeau-Riparia 2502 and Rupestris-Solonis Pecs. No. 101-14 was also eliminated as subject to phylloxera and suffering from frost. Nos. 219 A, 301 C., 301-37-152, 3309 and 333 developed to a very limited extent and produced only thin useless canes.

On the subject of the use of Riparia-Berlandieri-Teleki hybrids (4, 5, 6,7, 8 and 9) no opinion can be formed until the new plants selected at Dvor have been tried. They are hybrids which represent a mixture of forms.

In the nursery, where the soil is a heavy loam, difficult to work, the cuttings, some of them grafted and others ungrafted, are set to root. Nos. 219 A, 301-37-152, 301 A, B and C, 3309 and 333 strike root in insufficient numbers, as in fact do all the hybrids of the third group. The others strike roots in the proportion of 50 per cent. and some even above 70 per cent.

In grafting, the successes attain as much as 63 per cent. In a grafting experiment carried out in 1910 with Hengel St. Severinus' grafting machine the same percentage of successes was scored as by hand grafting, but it was observed that in machine grafting the stock does not keep the scion so well as with hand grafting. In the percentage of successful grafts no difference was observed between those stocks which had been previously forced

in a greenhouse and those which had not been so treated. The lowest percentages of successes were those with Riparia-Monticola 1 R (20.2) Aramon-Ganzin (29.8), Riparia-Berlandieri (33) and Aramon-Rupestris 143 B (33.5).

The experimental nursery for grafted vines (1.04 acres) is situated on a highly calcareous soil (68 to 72 per cent. of carbonate of lime). It has been planted gradually since 1906. In this nursery the behaviour of each hybrid when grafted is different from that which it shows when ungrafted ; for this reason the test of the various grafted hybrids is very important.

From 1906 to 1912 inclusive, 1270 vines, grafted on all the above-mentioned hybrids, were planted. Their development, notwithstanding all the care bestowed on them, cannot be said to be satisfactory. Chlorosis attacks more or less all the grafted stocks, so that it has already been necessary to uproot 521 of them on account of their excessive weakness (partly also on account of phylloxera in the case of Sol.-Rup 1616, 101-14 and 106-8). The vine " Grüner Sylvaner " suffers severely from chlorosis, especially on 1616, Aram.-Ganz. 106-8 and on the Teleki hybrids 6, 7, 8, 9 and 10a. This vine adapts itself badly to 1616, for during the six years that it has been grafted it has been sickly and has never yielded any crop. Grüner Sylvaner has hitherto succeeded only on Rip.-Mont. 1 R ; Welsch Riesling succeeds well, that is without suffering too badly from chlorosis, on Aramon-Ganzin 1202, 420 A, 33 and 34 E. M. Solon.-Rup. and 1 R. Gutedel (Chasselas) planted in 1906 and 1907 is relatively healthy only on 1616 and on Aram.-Rup. ; on 106-8 it has already become sickly. Weisser Burgunder (Pinot Blanc) planted in 1908 is of all scions employed the one which has been most successful on the hybrid stocks ; on 1 R and 41 B it succeeds very well and on Aram.-Ganz. and on 1202 satisfactorily.

The productiveness of all these grafted stocks is very low.

Of the 45 hybrids which have been experimented upon, only those of the first group (and in this excluding 106-8 which does not resist the attacks of phylloxera) can be taken into consideration for soils as calcareous as those of Dvor. Nevertheless the experience gained at Dvor during ten years already allows the conclusion to be drawn that in such soils viticulture has not much chance of success even adopting these hybrids.

748 – **Self and Cross-Fertilization Experiments with Vines.** — GARD, M. in *Revue de Viticulture*, Year XXI, No. 1069, pp. 649-656. Paris, June 11, 1914.

Referring to previous work (1) an attempt is made to determine the relative importance of different methods of pollination in vines and the variation which occurs according to the nature of the vine and the general external conditions. Three methods of pollination are distinguished : 1) self-pollination ; 2) pollination by another flower on the same plant and frequently on the same bunch ; 3) cross-pollination. Flowers are of four kinds: *a*) those which do not open at all ; *b*) those which open like ordinary phanerogamic flowers, the petals remaining attached to the floral receptacle; *c*) those which raise the corollary hood but do not push it right off (met with in certain natural and artificial hybrids, such as Croton, 117-4 Couderc,

(1) See No. 1430, *B.* Oct. 1912. (*Ed.*).

Secretary, 150 Seibel, Concord, Jacquez, Black Hawk) ; and *d*) those which open in the normal way. In wild species numerous male plants exist and cross-pollination is the rule, the hermaphrodite plants having short, curved stamens and being self-sterile, while in the European cultivated vine there is a distinct tendency towards self-pollination.

Certain cultivated species also have short, curved stamens, which, at flowering time, rapidly grow out of reach of the stigma ; a number of such plants were selected and a bunch of grapes on each was freed from unopened flowers with the exception of a single bud left at the extremity of the bunch; this was enclosed in a bag and when about to open, the cap was lifted and pollen from two of the anthers was shaken over the stigma ; negative results were obtained in all the following cases : *Vitis cordifolia* (6 flowers), Black Eagle (4 flowers,) Jaquez d'Aurelles (7 flowers), Blue Favourite (9 flowers), Massassoït (5 flowers), Catawba (1 flower). Some of the flowers fell off at once while others dried up gradually.

Whole bunches of the varieties Jacquez d'Aurelles and Blue Favourite were put into paper bags and showed that the flowers of a particular bunch were not inter-sterile. Castrated flowers of Jacquez d'Aurelles and Massassoït were also successfully fertilized by pollen from another bunch on the same plant. Fifteen castrated Massassoït flowers gave positive results with Black Eagle pollen.

749 – **The Cultivation of Olives in Tunis.** — GUILLOCHON, VERRY, TOURNIÉROUX and ROBINET, in *Bulletin de la Direction Générale de l'Agriculture, du Commerce et de la Colonisation*, Year XVIII, No. 77, pp. 268-296. Tunis, May 1914.

After a few historical notes on the cultivation of olives in Tunis, the writers discuss the various methods of propagation from seed, suckers, cuttings of different kinds and grafts. The number of cuttings to be obtained from a tree was determined ; two trees were chosen, both about a hundred years old ; one, with a solid trunk, produced 400 cuttings weighing about 1 lb. each, and the other, with a hollow trunk, produced 280 cuttings.

In Northern Tunis the olive groves are nearly all under the control of the Ghaba, which is an organisation founded to encourage the production of olives. The distribution of the groves in the various districts is as follows :

District	No. of olive trees
Grombalia	1 843 066
Tunis	1 026 704
Bizerte	476 631
Kef (including Tembourouk)	91 440
Beja (including Medjdez-el-Bab)	74 986
Maktar	72 303
Souk-el-Arba	83 798
Total	3 668 928

In Central Tunis the olive groves are found in a coastal belt about 56 miles long and from 2 ½ to 12 miles wide. The land is undulating

and those portions which are unsuitable for planting serve as catchment areas, being provided with trenches 2 to 6 ft. wide to lead the water into reservoirs. Groves may contain from 30 to 60 trees per acre. Their distribution in the various districts in 1913 was as follows:

District	No. of olive trees
Sousse	4 578 495
Kairouan	186 062
Tala	11 106
	4 775 663

In Southern Tunis the rainfall is very irregular so that plantations yield a less uncertain crop than annual plants and amongst trees the olive predominates. The following numbers existed in 1913 :

District	No. of olive trees
Sfax	2 803 642
Gafsa	196 743
Gabes	65 588
Military circle	259 633
Total	3 325 606

Numerous varieties are grown, both for the production of oil and for pickling, the most prevalent of the former kind being the Chitoui and the Chemlali of Tunis and Sfax.

The cost of harvesting, which is done either by hand picking or by knocking the fruit off with a pole, varies from 10 to 12 fr. per "caffis" (5*d* to 7*d* per bushel) in a good year to 40 fr. (2*s* per bushel) in a bad year. In those groves under the control of the Ghaba, the olives are sold by auction ; the owner then pays 20 per cent. and the buyer 3 per cent. of the sale price to the Ghaba for managing the grove ; usually a net return of 4*d* to 10*d* is obtained per tree, but the crop is very uncertain and varied from 48 000 tons in 1911 to 5000 in 1910. In Central Tunis the yield is also vary variable ; from data obtained during five consecutive years it is estimated that a return of 5 or 6 per cent. should be obtained. In the south, olive trees under good management are estimated to produce :

at 8 years	¼ to ½	bushel	per tree
» 10 »	½ to 1	»	» »
» 15 »	1 to 3	»	» »
» 25 »	3 to 5 and 7	»	» »

The trees may be expected to maintain their yield for a considerable time under good management.

Oil extraction is carefully done in Tunis, and the oil is chiefly sold in France and Italy. The relative production of oil in the northern, central and southern regions respectively is about 1 :1 : 4, the total production being as follows :

	Production in hectolitres (1 hl. = 22 galls.)	Value per kg. in frs.
1900	339 800	0.70
1901	265 200	0.70
1902	161 770	0.62
1903	392 500	0.62
1904	255 650	0.62
1905	244 800	0.62
1906	243 000	0.62
1907	392 900	0.60
1908	68 000	1.00
1909	420 000	1.00
1910	550 000	1.00
1911	420 000	1.00
1912	205 000	1.50
1913	345 000	1.50

Numerous parasites, both insect and fungoid, attack the olive trees in Tunis. The Government does a good deal to encourage the cultivation of olives ; over and above the institution of the Ghaba, pruning competitions are held, and it is compulsory that all fallen fruit should be collected in order to check the propagation of the olive fly (*Dacus oleae*); further, all grafted olive trees are exempt from land tax (canoun) for fifteen years.

750 – **Avocados: *Persea gratissima* Gaert. and *Machilus glaucescens* Wight.** — RIVIÈRE, C., in *Journal d'Agriculture tropicale*, Year XIV, No. 155, pp. 132-137. Paris, May 31, 1914.

Machilus glaucescens is still somewhat unknown as a fruit tree. The fruit is not as large as that of the avocado, sometimes more drawn out, always green with somewhat oval and pointed seeds. The flesh is greenish and similar to the avocado in consistency and flavour. The tree is prolific, especially every alternate year, and more resistant to violent fluctuations of climate than the avocado. Its hardiness should make it very suitable as a stock for the avocado ; methods of cultivation are identical for the two plants.

LIVE STOCK AND BREEDING.

751 – **Investigations on the Presence of Tubercle Bacilli in the Flesh, Blood, and Intermuscular Lymphatic Vessels of Tuberculous Calves.** — HAEUTLE, CHR. in *Centralblatt für Bakteriologie, Parasitenkunde u. Infektionskrankheiten*, Vol. 74, Part 1-2, pp. 91-130. Jena, May 27, 1914. HYGIENE

The writer made intraperitoneal injections into 161 guinea-pigs and 9 rabbits, with blood, muscular-serum, and serum obtained from the intermuscular lymphatic vessels of 36 more or less tuberculous calves, with a view to solving the question of the pathogenic power of bovine tuberculosis. The most important results may be summarized as follows :

1. In the case of fat calves suffering from severe tuberculous infection of the spleen, liver, kidneys, lungs and so-called lymphatic vessels of the flesh, no infection of the blood is as a rule discernible.

2. No tubercle bacilli can be discerned in the muscular tissue of tuberculous calves, even in those cases in which the lymphatic vessels immediately connected with it shew tuberculous lesions or swelling.

3. Tuberculous infection of the lymphatic vessels may be present, even if they exhibit no tuberculous lesions ; and in the case of such fresh infection of the lymphatic vessels, still imperceptible macroscopically, the muscular tissue proves free from tubercle bacilli.

4. The macroscopically latent infection of the lymphatic vessels in a calf does not presuppose the infection of the blood by tubercle bacilli. The infection of these vessels must, in the absence of infection of the blood, be considered as communicated through the lymph ducts from other already infected vessels.

5. The mere swelling of a lymphatic vessel of the flesh is not invariably to be regarded as a definite indication of the infection of that vessel or of the muscular region connected with it, and in the same way the fact that a vessel retains its normal shape and size is no guarantee that it is free from tubercle bacilli.

FEEDS AND FEEDING

752 – **The Importance of the Inorganic Constituents of Feeding Stuffs.** — ZAITSCHEK, A., in *Allatorvosi Lapok*, Year 37, No. 19, p. 225. Budapest, May 9, 1914.

In collaboration with St. Weiser, the writer instituted investigations into the influence of the inorganic ingredients of foodstuffs on the development of bone in young pigs. The experiments shewed in the first place that when the animals were fed exclusively on maize, they excreted, in in spite of putting on muscle, more calcium than they retained, and made up the deficit with magnesium. Later, when the quantity of dry food was raised somewhat (from 700 gms. to 918.9 gms. for example, in the case of a pig weighing 98 lbs.) and 5 gms. of calcium carbonate added to the maize food, the deficit in calcium was replaced by a heavy increase, the amount of magnesium retained falling at the same time from 0.5092 gm. to 0.1013 gm. Simultaneously the quantity of phosphoric acid retained rose from 13 per cent. to 30.1 per cent. When the pig, weighing 115 lbs. was fed on barley only, getting 900 gms. of barley and 160 of starch every day, a slight surplus of calcium resulted, which was not sufficient to ensure a corresponding development of bone. An addition of 3 gms. of calcium carbonate to the daily ration produced a high absorption of calcium and phosphoric acid.

As the minimum quantity of calcium required depends on a variety of circumstances, it cannot be definitely indicated in such a way as to admit of growing pigs bring kept accurately balanced as regards calcium. In the experiments, a high absorption of calcium and phosphoric acid resulted when 10 or 11 gms. of calcium carbonate were added to the food per 100 kg. of live-weight. When young pigs were fed exclusively on maize, or maize and barley, the bones did not develop properly but seeing that both maize and barley contain phosphorus in sufficient quantity, it appears unnecessary to use the more expensive calcium phosphate in place of calcium carbonate. Pigs reared in the open usually pick up lime along

with earth, etc. and therefore under such circumstances it is superfluous to give them lime ; but animals, and especially young fattening pigs, in the sty, cannot supply their requirements as regards lime, and the lack of it only too easily renders the fattening process unsuccessful.

753 – **Feeding Experiments with Lupin and Horse-Chestnut Flakes.** — HAUSEN, REISCH, EWALD and LILIENTAL in *Illustrierte Landwirtschaftliche Zeitung*, Year 34, Nos. 42 and 43, pp. 391-392 and 399-400. Berlin, May 27 and 30, 1914.

The writers conducted some feeding experiments with lupins and with horse chestnuts deprived of their bitter principles by a new German process (1) and rendered suitable for feeding purposes. They used only the flakes prepared from blue lupins and from horse chestnuts without any other admixture. The contents in nutritive matter which the writers compared with previous analyses by Bässler are the following:

	Lupin flakes		Horse-chestnut flakes per cent.
	Writers' analysis per cent.	Bässler's analysis per cent.	
Dry matter	82.0	91.4	85.0
Crude protein	25.7	27.7	6.7
Pure protein	22.9	—	5.1
Crude fats	4.0	2.1	3.9
Nitrogen free extract	36.3	42.6	67.8
Fibre	9.1	11.2	3.5
Ash	7.2	7.7	3.2

The lupin flakes still had, as Bässler had also observed, a fairly bitter taste ; their alkaloid content was 0.18 per cent.

If the coefficient of digestibility for disembittered lupins and for horse chestnuts given in the literature on the subject be taken for these new flakes, they would contain the following amounts of digestible food :

	Dry matter per cent.	Crude protein per cent.	Fat per cent.	Carbo-hydrates + crude fibre per cent.	Protein per cent.	Starch value per cent.
Lupin flakes	82.0	23.4	3.5	41.8	20.6	63.8
Chestnut flakes	86.0	4.9	3.3	63.0	2.4	72.4

(1) The process, invented by VON FEHRENTHEIL of Liegnitz, is described and illustrated by P. HOEPFNER in *Illustrierte Landw. Zeitung*, No. 6, 1912.

(2) See *Landwirtschafliche Wochenschrift für Pommern*, p. 12, 1911.

Lupin flakes are therefore a food rich in protein and chestnut flakes in starch.

The animals experimented upon were cows and sheep; it was intended to feed them with both kinds of flakes, but the cows refused the lupins on account of their bitter taste and so only chestnuts were given to them.

I. *Fattening lambs with lupin flakes.* — The animals experimented upon were 24 yearling lambs divided into two equal groups. The first group was fed a basal ration of meadow hay, mangolds and barley groats, and as food for purposes of comparison 0.4 lb. of bean groats and earthnut meal per 100 lbs. live-weight. The second group got the same basal ration plus 1.1 lb. of lupin flakes per 100 lbs. live-weight. The experiment proceeded without any noteworthy incident, the lupin flakes being eaten up readily. The result was as follows :

	Group I lbs.	Group II lbs.
Increase per animal in 73 days	28.82	28.38
» » per day	0.396	0.389
Carcase weight in percentage of live weight. . . .	47.9	47.9

The lupin flakes thus had the same nutritive effect as a corresponding quantity of nutriment given under the form of beans and earthnut cake.

II. *Fattening lambs with chestnut flakes.* — In this experiment 24 Hampshire lambs were employed ; they also were divided into two equal groups, the first of which was fed a basal ration consisting of meadow hay, dried beet slices and soy bean meal, and, for comparison with the chestnuts flakes, 1.1 lb. of wheat bran and 0.66 lb. of maize per 100 lbs. live-weight. The second group received the same basal ration and 2.64 lbs. of chestnut flakes per 100 lbs. live-weight. During the whole time the chestnut flakes were readily eaten, and notwithstanding the large amount fed, did not affect the health of the animals. The following are the results :

	Group I lbs.	Group II lbs.
Increase of weight per animal in 73 days.	24.42	15.84
» » » per day	0.33	0.22
Carcase weight in percentage of live weight	48.8	45.6

According to the opinion of the butcher the lambs of the first group were not perfectly fattened, but still fat enough and provided with sufficient tender meat, while the lambs fed on chestnut flakes were thin and their flesh was soft and watery. On the whole the chestnut flakes proved unsatisfactory.

III. *Experiments with chestnut flakes for milch-cattle.* — Four cows were fed a basal ration consisting of hay, dry beet slices and soy bean meal and, during three periods, 0.8 to 3 lbs. of maize groats and 2 lbs. of wheat bran per 1000 lbs. live-weight, in comparison with 2 lbs. of chestnut flakes, fed during one period and 4 lbs. of the same flakes fed

during another one, always per 1000 lbs. live-weight. The experiment proceeded without any hitch and after the first three days the cows ate their chestnut flakes readily enough. These flakes however had the drawback, that during the fortnight during which 4 lbs. of them were given all the cows suffered from scour. The same happened when at the end of the tests the flakes that remained were fed to all the cows in the experimental herd. On the milk yield the chestnut flakes did not seem to have any effect, favourable or unfavourable, from which it appears that in doses up to 2 lbs. per 1000 lbs. live-weight, they can be freely fed to cows.

From the above experiments the writers conclude that while the preparation of these flakes is certainly interesting, the difficulties attendant upon their use render it doubtful whether it will be profitable to go on producing them.

754 – **Breeding Ardenne Horses in Sweden.** — ABRAMSON, ERIK. Pp. 14, Köping, 1914. HORSES, ASSES AND MULES

Ardenne horses began to be bred in Sweden in 1873, when Count Wrangel imported into Värmland two Belgian Ardenne stallions. The results obtained were so satisfactory that after a few years Count Wrangel imported 18 pure bred stallions and 14 mares. By the early eighties the importations of Ardenne horses into Southern and Central Sweden had become almost general. The crosses between Ardenne stallions and the native mares were more satisfactory than the native horse improved by Norvegian and thoroughbred blood. It was especially in Västergötland that the breeding of Ardenne horses reached a high degree of perfection. About the middle and towards the end of the eighties other breeds, such as Clydesdales, Shires, Percherons and Pinzgauers were used for crossing, but about the middle of the nineties it was clearly recognized in Sweden that on the whole the most suitable horse for the country was the Ardenne.

Since then the breeding of Ardenne horses in Sweden, assisted also by the State, has continued to develop. Up to 1900 the distribution of prizes by the State was almost exclusively for outward conformation, but since then the value of pedigree has been recognized. From this reorganization of the standards for the distribution of prizes the consolidation of the breeding of Ardenne horses in Sweden may be said to date. A further encouragement was the foundation of the Studbook Society for Swedish Ardenne horses with the assistance of the State and of the agricultural associations. It published a studbook for the whole country, in which only the Ardenne horses recognized by the State Committee for prizes are admitted. Up to 1913 inclusive, 4631 horses, 680 of which are stallions, have been entered.

In Sweden, besides the Ardenne horses, which are the most important, another breed of heavy draught horses is raised in the most northern provinces. These breeds are kept separate and serve different purposes. The Ardenne horse is employed in farm work and the smaller draught horse of the north is in demand for work in the forests. To a small extent Clydesdales are also bred.

The State and the agricultural societies spend yearly about £17 600 under the form of prizes for the encouragement of the breeding of draught horses which is for the most part carried out by the peasants. The stallions belong exclusively to associations formed for the purpose or to private owners. In Sweden there are only very few stud farms for Ardenne horses, those of Blomberg in Västergötland and of Bjärka-Säby in Östergötland being the best known.

The importation of Ardenne horses from Belgium is limited at present to only the best breeding animals for which not infrequently from £550 to £825 are paid for stallions and £165 to £220 for mares. In general in Sweden it is not the largest and heaviest Ardenne horse that is bred, but a meium-sized one combining strength, resistance and agility.

CATTLE

755 – **Experiments on the Profitable Feeding of Milch-Cows.** — GOLDSCHMIDT, H. (Royal Veterinary and Agricultural College, Copenhagen) in *Dansk Land*, Year 1, December number, pp. 453-470. Copenhagen, 1913. (Summarised by the writer).

This experiment is a kind of continuation of previous feeding experiments. These latter aimed partly at a comparison between the effect, that is the economical result, of a ration composed according to the usual empirical rules and that of another composed, with due consideration to the amount of nitrogenous and nitrogen-free matter in the different foods, in a manner proportional to the yield of milk of the different cows ; the experiments were also carried out to demonstrate that the so-called equivalents (" Ersatzzahlen "), the use of which during the last decades has spread greatly in Scandinavia and other countries, cannot be used alone when it is a question of compounding profitable rations for milch-cows, though they may perhaps be useful in the calculation of the money value of the food. Besides, these experiments serve to detect some errors in the feeding of cattle, as for instance using straw *ad libitum*.

The present experiment, which takes, lucerne as basal ration, is to be considered as a preliminary one ; especially as lucerne is still of relatively recent introduction in Denmark.

In the experiment two groups of ten milch cows each were employed. At first, during the period of observation, the cows were fed exclusively on lucerne *ad libitum*. It appeared in this period, among other things, that the weight and performance of the individual cows did not stand in any approximatively constant relation to the quantity of lucerne consumed, and that the older and drier the lucerne, the less of it was eaten.

In the experimental period which followed the observation period the cows of both groups were given 77 lbs. of lucerne and 2.2 lbs. of straw ; but while Group I received also 1.02 lb. of oilcake (containing protein) for every 10 lbs. of milk, Group II received a quantity of oats corresponding to the equivalent figures (Ersatzzahlen), namely 1.33 lb. for every 10 lbs. of milk. These rations were fed for the first 25 days, after which, for the remaining 20 days of the experiment, Group I was fed oats and Group II oilcake.

In both groups oilcake produced the greatest yield of milk. If the equivalent numbers had been correct, under the above mentioned condi-

tions the two concentrated foods should have had the same effect upon the production of milk.

That the addition of oilcake to a forage so rich in protein as lucerne was able to cause a relatively greater increase in the milk yield than the oats is due not only to the fact that the content of digestible protein in the lucerne (77 lbs.) was not large enough without further addition to cover the want of this substance, but also to the fact that the relatively large amount of nitrogen-free matter contained in the oats was not capable of balancing the comparatively low content of protein in this food. or, in other words: the above result shows that it is comparatively easy to force the yield of milk by the use of protein at the expense of the fat contained in the body, when the cows are in good condition (which was the case in this experiment), while it is difficult to do so with carbohydrates at the expense of the protein-containing tissues of the body.

According to the calculations which have been made on the basis of the analyses of the foods employed in the experiment and according to the quantities of milk obtained and the weights observed (test milkings were made daily and the cows were weighed every 5 days,) the following conclusions were drawn :

1. Lucerne alone can only exceptionally and temporarily afford a profitable food for milch cows.

2. Lucerne combined with other food is one of the best fodders for milch cows. In proper proportions lucerne is admirably suited to increasing the profitableness of cattle keeping.

3. Under the given conditions, when it was a question of compounding an economical ration for cows in excellent condition, the addition of oilcake, to a limited quantity of lucerne (77 lbs.) was more favourable to the yield of milk than a corresponding quantity of oats (on the basis of equivalents).

The results of the experiment show further that the substitution of foods rich in protein by those rich in carbohydrates may produce exactly the same milk yield without justifying the conclusion that in any particular case one food can effectively replace a corresponding quantity of the other food. This observation has long since and repeatedly been made by the writer.

On the basis of these results and the considerations to which they give rise a series of general rules may be established for the use of lucerne during the various periods in summer.

1. As long as the lucerne is young, that is up to about the 15 th. of June, it is to be supplemented by mangolds (or if necessary cereals, etc.).

2. From the 15th. of June to about the 15th. of August lucerne, being older, is to be fed with oilcakes, or, if it is fed in smaller rations, with oilcake and cereals, etc.

3. From the 15th. of August to about the 10th. of September lucerne, should be supplemented by oilcake and mangolds.

The report contains a number of suggestions for mixtures of varying quantities of lucerne with several other foods.

PIGS

756 – **Investigations into the Metabolism and the Potential Energy of Foods in Growings Pigs.** — FINGERLING, KÖHLER, REINHARDT, BRETSCH, ARNDT and DIETRICH in *Die Landwirtschaftlichen Versuchsstationen*, Vol. 86, Parts 3 and 4, pp. 149-230. Berlin, May 25, 1914.

These experiments are a continuation of those of Kellner on the utilization of pure foodstuffs by ruminants. The method followed differed somewhat from Kellner's: the two animals under experiment were given, in a preparatory period, a basal ration consisting of a mixture of barley groats, meat meal, phosphate of lime (" Futterkalk ") and common salt. In the following period, pig. no. 1 was given successively, besides the basal ration, potato starch, earthnut oil, " strohstoff " (straw cellulose, obtained by boiling straw under pressure in an alkaline medium) and gluten; pig no. 2 was given meat meal (0.66 lb.) and sugar. Lastly both pigs were fed the basal ration again, the same in quantity and quality as at the beginning of the experiment. The different periods lasted 13 to 14 days (some only 12) and the observations made during this time dealt with the metabolism and consumption of energy, from which the utilization of the food given was calculated.

The result of these investigations demonstrated that pigs utilize the productive parts of food to a greater extent than is the case with ruminants. When the individual foods are given separately in an easily digestible form, as in gluten meal, starch meal, earthnut oil, " strohstoff " and sugar, their higher utilization by pigs as compared with the same by mature cattle is as follows:

Gluten protein	35.1	per cent.
Fat	31.8	» »
Carbohydrates	30.0	» »
Crude fibre	0.0	» »
Sugar	32.1	» »

With the exception of digestible crude fibre, which is not more utilized by pigs than by cattle, the better utilization of the different foods attains nearly the same value. It appears thus that Kellner's starch values, which are only relative figures, may be used also for calculating the rations of pigs, all the more as crude fibre has only a secondary importance in the rations usually given to pigs.

POULTRY

757 – **Rearing Ostriches in Madagascar.** — *Bulletin de l'Office colonial du Ministère des Colonies*, Year VII, No. 76, pp. 189-200. Melun, April 1914.

The ostrich farm at Tulear made satisfactory progress during 1912 and another is being established at Befamany. The diet of lucerne has proved very healthy for the birds whose plumage has considerably improved, the tail feathers of the male birds fetching as much as 36 *s* per lb. Anthrax has accounted for a good many deaths and it is suggested that the anthrax organism is able to live in the body of the ostrich as a saprophyte, becoming pathogenic when the general health of the bird is bad; the fact that large numbers of the organism are found in the body of ostriches who have died after excessive exercise, lends support to this hypothesis.

758 – **Mulberry Leaves Preserved in Cold Storage.** — BUFFA, P., 8 pp. Riccardo Bigontina, 1914. SILKWORMS

More than a ton of mulberry leaves were distributed in 39 boxes made of zinc or wood and in various sizes; the boxes were closed and kept in cold storage at a temperature of 2° C. (35.6° F.) from June to August, after which they were used to rear silkworms and compared with fresh leaves for that purpose. Atmospheric conditions were most unfavourable throughout the experiment.

From the results obtained the following conclusions were drawn:

1. Large quantities of mulberry leaves can be preserved by means of cold storage.

2. The temperature of the storage chamber should be constant between 1° and 2° C. (33.8 and 35.6° F.).

3. It is better to precool the leaves for a few hours before putting them into the storage chamber.

4. The containing boxes should not be of greater capacity than 3 cu. ft. (holding 56 lbs. of leaves) and should be packed in the chamber in such a way as to allow free ventilation in all parts.

5. Stored leaves were eaten with as much relish by the silkworms as fresh leaves and gave equally good results with regard to both the worms and the cocoons produced.

6. The cost of storing the leaves in a chamber of 4200 cu. ft. capacity amounted to 1*s* 9*d* per cwt.

759 – **Sericultural Products in Persia.** — LAFONT, F. in *Bulletin mensuel de l'Office des Renseignements agricoles*, Year XIII, No. 4, pp. 418-420. Paris, April 1914.

The trade in silkworm eggs in Persia is practically entirely in the hands of Greek merchants who obtain nearly all their graine from abroad. There are, however, a few isolated breeders in Persia and a certain amount of unselected graine is also produced and sold fraudulently as imported selected graine. Imports during the past 8 years are given in the following table.

Imports of graine in ounces of 25 gms. (= 0.88 *oz. avoir.*).

1905-1906	242 413
1906-1907	346 202
1907-1908	398 156
1908-1909	—
1909-1910	322 246
1910-1911	308 782
1911-1912	372 640
1912-1913	280 000

Four-fifths of the imports come from Turkey, and the rest from Russia, while insignificant amounts are obtained from France and Italy, the importation of graine from western countries being impeded by local prejudice. The eggs are usually sold on credit the cash price being about 4*s* per oz. of 25 gms.

There are no statistics as to the production of cocoons in Persia, but this is estimated at 5950 tons of raw material per annum. This low production is due to defective rearing methods and to the poor quality of the eggs which are frequently diseased. The cocoons are of poor quality and fetch 7*d* to 8 ½*d* per lb. in the raw state ; they are chiefly exported to France and Italy ; those not exported are worked up by the cultivators themselves, who only have very primitive apparatus at their disposal and turn out a rough, faulty, dull tissue which would be unsaleable in Europe ; the best qualities are worth 8*s* 6*d* to 9*s* 3*d* per lb. according to the state of the European market. Not more than about 120 tons of waste is produced per annum, best quality floss fetching about 1*s* 6*d* per lb. at Constantinople.

It would certainly be more profitable to export the silk in the form of good reeled silk than in the form of cocoons and there would seem to be an opening for European reeling mills in Guilan, Mazanderan, and Khorassan. The present production would require about 20 000 modern reeling units. The chief obstacle to the establishment of such mills is the mussulman customs which prevent men from entering the workshop where women are working, consequently preventing proper superintendence of the work.

FARM ENGINEERING.

AGRICULTURAL MACHINERY AND IMPLEMENTS

760 – **New Implements used at the Flahult Experiment Farm, Sweden, in the Year 1913.** — AKERBERG, H. in *Svenska Mosskulturföreningens Tidskrift*, Year XXVIII. No. 2, pp. 147-154 + 7 figs. Jönköping, March 1914.

At the Flahult Experiment Farm the following implements were tested last year : a dung spreader, a Swedish lime and artificial manure spreader, a combined field leveller (Ackerschleife) and spring tooth harrow, a rotary harrow and three different ploughs.

The *dung spreader* is built for one horse and consists of a cart with a moveable bottom, which, like an endless chain, carries the dung towards the back of the cart, where a distributor scatters it in a finely divided state behind on the same principle as that adopted by the large manure spreaders of the International Harvester Co. The width over which the manure is spread is 4 feet. One man and one horse working 10 hours can manure from 1 ¼ to 1 ½ acres a day at the rate of 8 tons to the acre. The machine is therefore suitable for small farms. The work done was excellent with both large and small quantities of peatmoss dung.

The *"Albion" artificial manure spreader*, which is built chiefly for spreading pulverized lime, was used for basic slag and potash salts. The work done was satisfactory, but attention had always to be paid to the speed at which the machine was driven, as this influences the quantity distributed. When the weather was damp the spreading was not so good. Further experiments with superphosphate showed that this fertilizer cannot be spread with the machine, as it is liable to choke it.

The *field leveller and spring-tooth harrow* "Svensk" was tried on a fen and on sandy soil, but with no great success, as the soil was too loose. On heavier and firmer soil it appears to work better.

The *rotary harrow* "Hankmo" from Finland resembles Wassis' spade harrow, but differs from it in that the axles are adjustable and the spades are replaced by narrow, pointed, slightly curved blades. This harrow was tried on moor and fen land, as well as on sandy soils; it was used on ploughed land, stubble and after beets, and every where worked satisfactorily. On old, stiff, unbroken meadows the soil was rendered fit for sowing by going over it twice with the Hankmo and once with a smoothing harrow. It requires considerable draught in consideration of the width of work done.

The *swing ploughs* Reval 1 and Reval 2, built by the Swedish Norrahammar works, for Russian moor soils, were used on moor and fen land. No. 1. proved very useful for cultivating and for breaking up old stiff tussocky meadows. No. 2, was not so good for moor soils.

The third *plough* tried, the "Victoria", was built on the American Albion type. The specimen tried had been specially modified for moor soils. On old compact moors the performance was satisfactory; for loose, imperfectly decomposed or wet moors it is not so suitable. On mineral soils it worked admirably.

761 – **Tile-Drain Trench-Digger.** — *Engineering*, Vol. XCVII, No. 2525, p. 708. London, May 22, 1914.

In countries where irrigation is recent, as in America, South Africa, etc., the tendency has been rather to neglect drainage, with the frequent result of waterlogged soil and a consequent falling off in the crops.

Where the tracts of land are large and labour scarce, drainage presents difficulties, which tend to the mechanical treatment of the problem. Thus the mechanical excavator has been adapted to this kind of work. The accompanying figure illustrates a successful form of tile drain ditcher built by the Austin Drainage Excavator Co., of Chicago, U. S.

It is constructed to travel over soft ground. Eighty-five per cent of the 5 ½ tons that the machine weighs is supported by an endless chain of flat feet on each side and at one end of the machine. The pressure per square foot on the ground is only 390 lbs. The other supporting wheels are of the usual broad-tyred pattern and they are not near the trenching operations.

The trench is cut by a series of scoops or buckets, with lips of forged steel, attached to an endless chain and carried by a ladder or boom which is hinged at one end to a vertical frame, on an extension of which pass the cables for adjusting the height of the ladder.

The buckets can easily be fixed or removed from the chain. They are made three sizes: 10, 12 and 15 inches, which, with side cutters, secure trench widths of 12, 15 and 17 in. respectively. The buckets are cleaned of their contents by a strong fixed scraper which clears clay as effectively as light soil. The material brought up is delivered by the belt of a conveyor to one side of the trench.

The ditcher can excavate to a depth of 6 ft. according to the position of the ladder.

For usual conditions, making a cut 10 to 15 in. in width, 6 ft. deep and advancing at the rate of 15 ft. per minute, a two-cylinder 14 to 16 HP petrol engine is mounted on the machine. Steam power can be applied if preferred. It is self-propelling and moves on roads at 1 ½ to 3 miles an hour. It can turn in its own length.

It is estimated that the cost of running under normal conditions in the United States, including repairs, is less than $10 per 10-hour day. Large sized ditchers cut trenches up to 40 in. wide and 12 ft. deep.

762 – **Spring-tooth Cultivator.** — From Report of Patents, in *Wiener Landwirtschaftliche Zeitung*, Year 64, No. 18-19, p. 164. Vienna, March 21, 1914.

The novelty in the cultivator recently patented in Germany in Class 45 a, under Number 60 999, consists in the flat spring teeth being laterally twisted in their lower extremity (see fig. 1). By this means the teeth can, according as they are raised or lowered and turned inwards or outwards, increase or diminish the heights of the ridges and adapt themselves to any form of ridge or bed and distance of rows. In the framework *a* are fixed two pivots *b* round which square axles *cc'* can turn. The spring teeth *dd* are fixed to the axles by clamps *ff*; a connecting rod *i* unites the levers, *hh'* attached to the axles *cc*. The lever *h'* is lengthened to an adjustable hand lever *h''*. The position of the wheels *n* can also be regulated as to height and width of gauge. Each of the spring teeth can be so shifted as to correspond to the shape of the ridge to be worked (see fig. 2), while the depth to which the teeth penetrate into the soil is regulated by turning the axles *cc*.

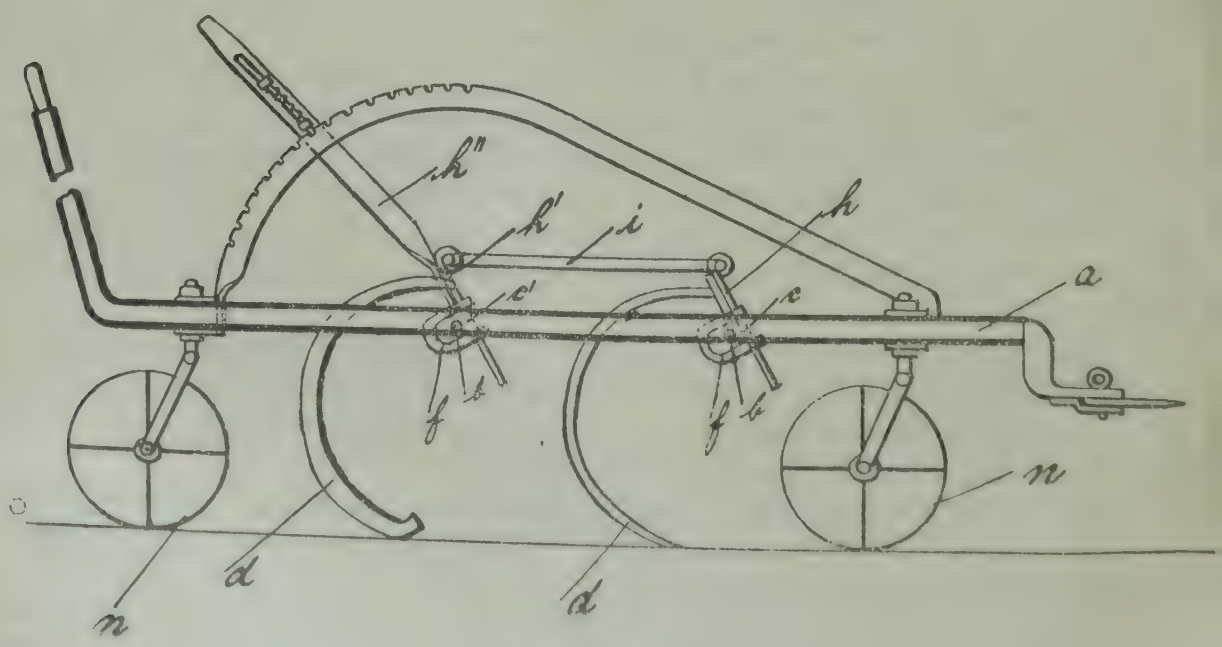
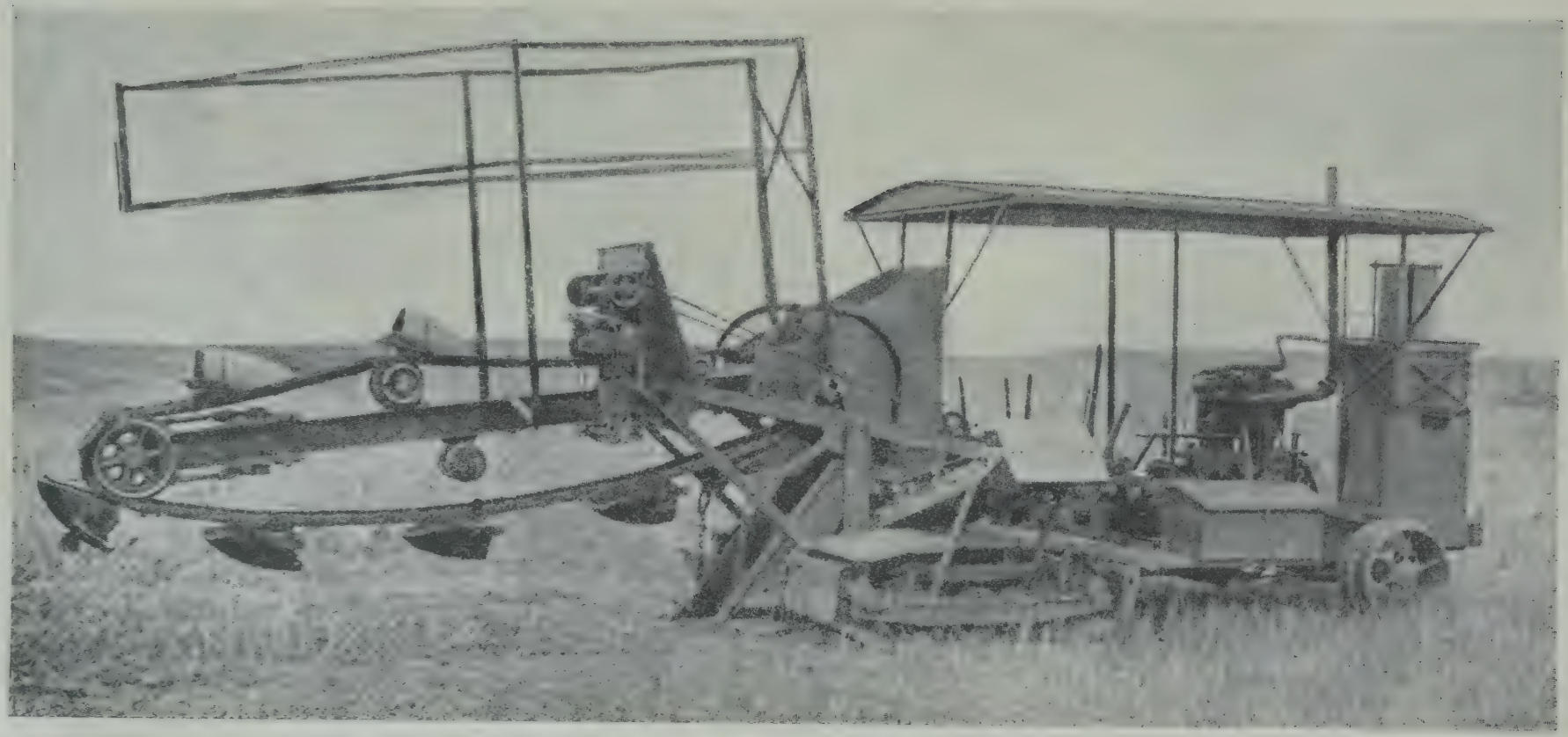


Fig. 1. — Spring-tooth cultivator (side elevation).



Tile-drain trench-digger made by the Austin Drainage Exavator Co., Chicago, U. S. A.

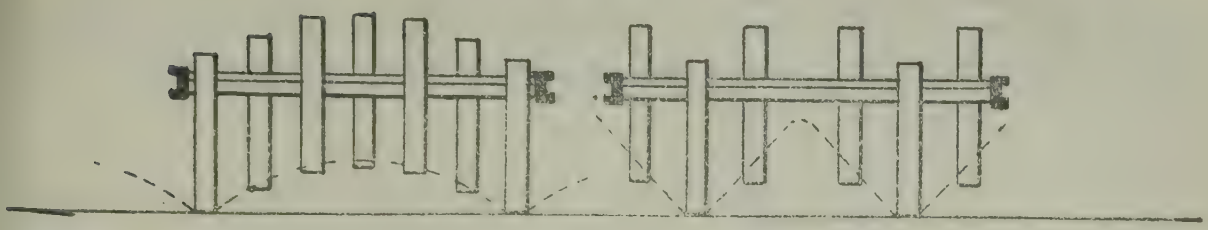
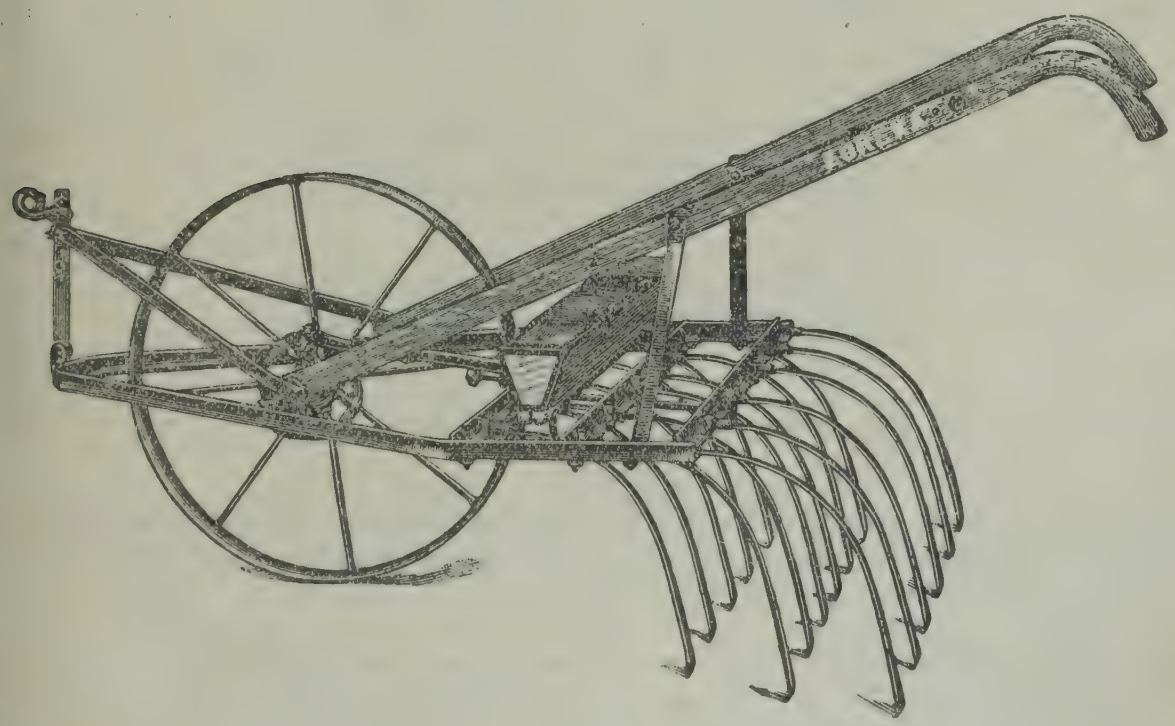


Fig. 2. — Spring-tooth cultivator, showing adaptation of teeth to ridges.

763 – **A New Mulcher and Seeder.** — *Farm Implement News*, Vol. XXXV, No. 16, p. 32. Chicago, Ill., April 16, 1914.

The new three-foot mulcher and seeder shown in the accompanying figure has lately been placed on the market. It is described as a mulcher, smoothing harrow, surface cultivator, seed sower and weeder, all in one. It enables farmers to sow grass seeds or grain between rows of other plants. The teeth cover the seed perfectly and level the ground . One horse only is needed.



A new mulcher and seeder.

764 – **Combined Horse-Hoe and Roll for Beets.** — *Blätter für Zuckerrübenbau*, Year XXI, No. 10, p. 161 + 3 figs. Berlin, May 31, 1914.

This device is patented in Germany under No. 267 840. It allows of several rows of beets being hoed and rolled at the same time.

The rollers and the hoes work independently of each other and can adjust themselves to inequalities of the field, being attached by separate arms, *b* and *d* (see fig. 1, side view, and fig. 2, plan), to the frame, *a*, of

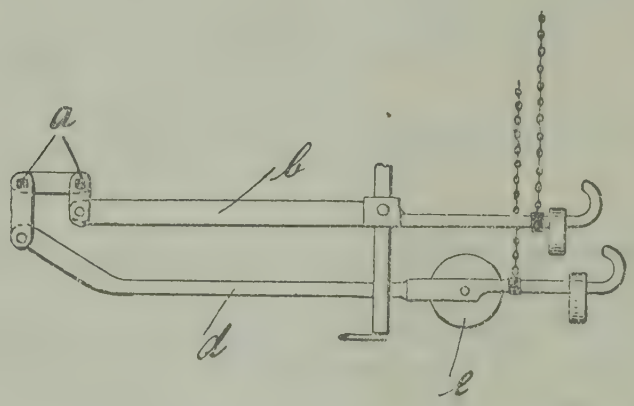


Fig. 1. — Combined horse-hoe and roll for beets (side elevation).

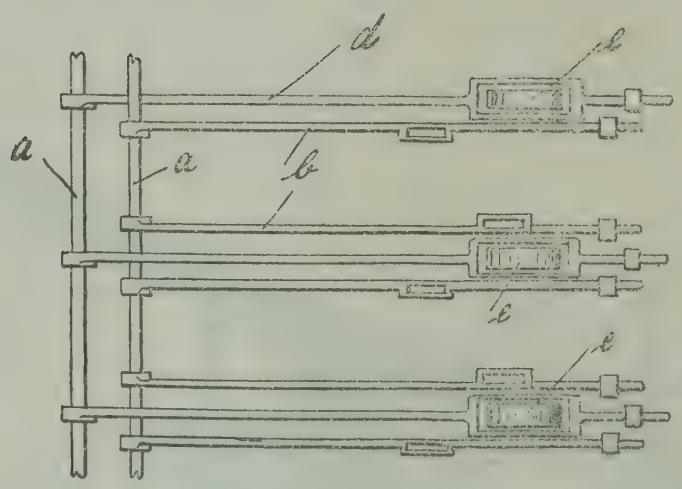
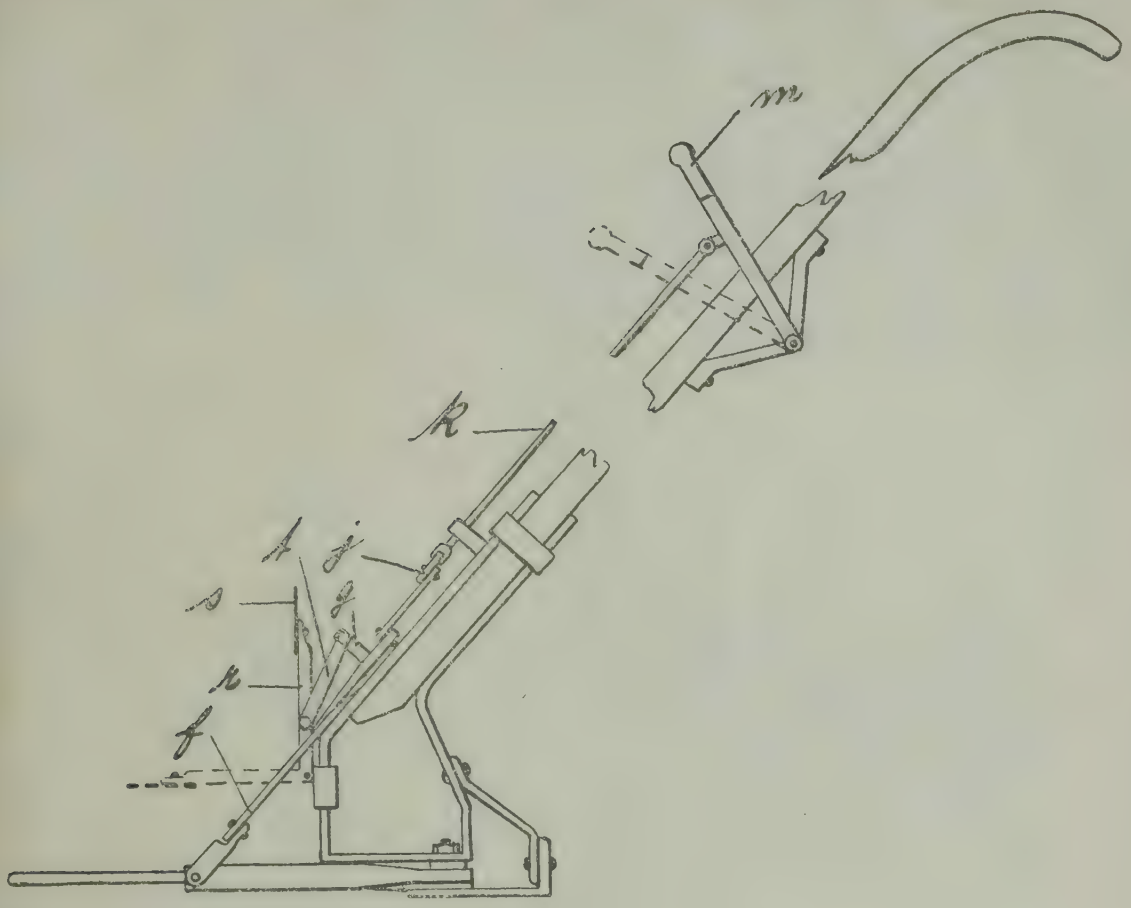


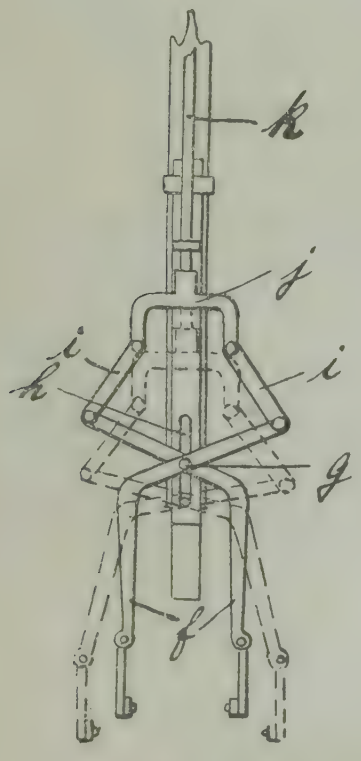
Fig. 2. — Combined horse-hoe and roll for beets (plan).

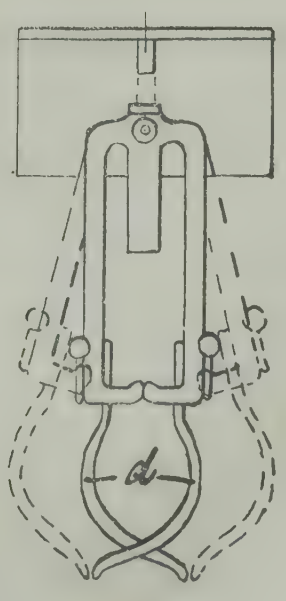
the machine. In heavy soils both hoes and rollers are provided with weights (*f*). The machine is fitted with steering gear fore and aft, so as to ensure the greatest precision of work.

765 – **Hand Beet-Lifter.** — *Blätter für Zuckerrübenbau*, Year XXI, No. 8, p. 129 + 3 figs. Berlin, April 30, 1914.

The hand beet-lifter shown in figs. 1, 2 and 3 is patented in Germany under No. 267230. It lifts and tops at the same time ; the cutting blade is fixed by an articulated joint to the rest of the implement in such a way that it assumes a position parallel to the jaws when these are open and turns up when they are closed. For opening and shutting the claws and lifting and lowering the blade *s*, the hand-lever, *m*, is used. It acts upon the connecting rod, *k*, a cross piece, *j*, the joint, *i*, and the claws, *f*, the bolt, *g*, of which works in a slot, *h*.



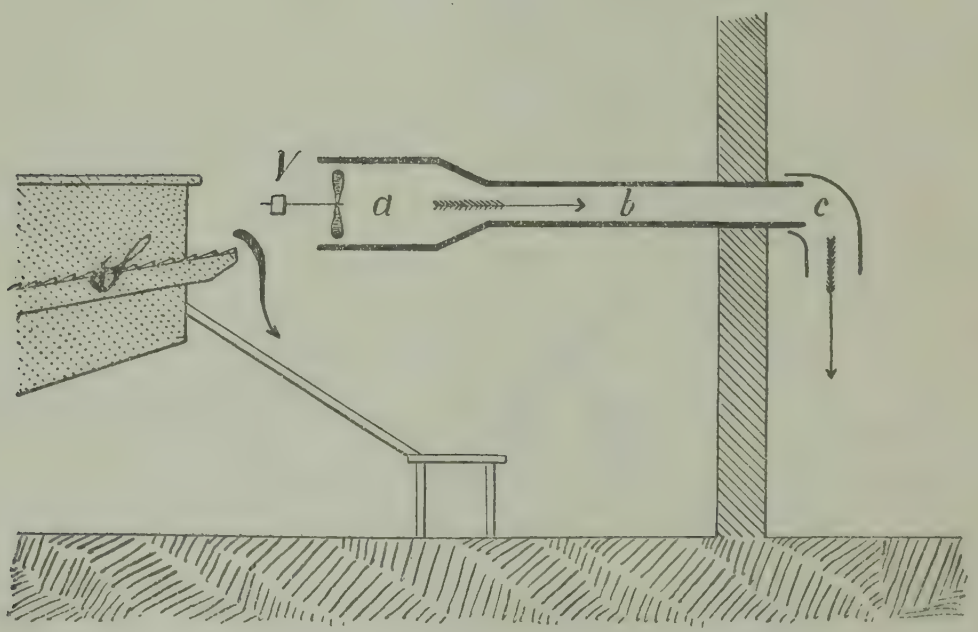




Hand beet-lifter.

766 – **Apparatus for Removing Dust while Threshing.** — DUVAL, CH. in *Journal d'Agriculture Pratique*, Year 78, Vol. I, No. 20, p. 624, Paris, May 14, 1914.

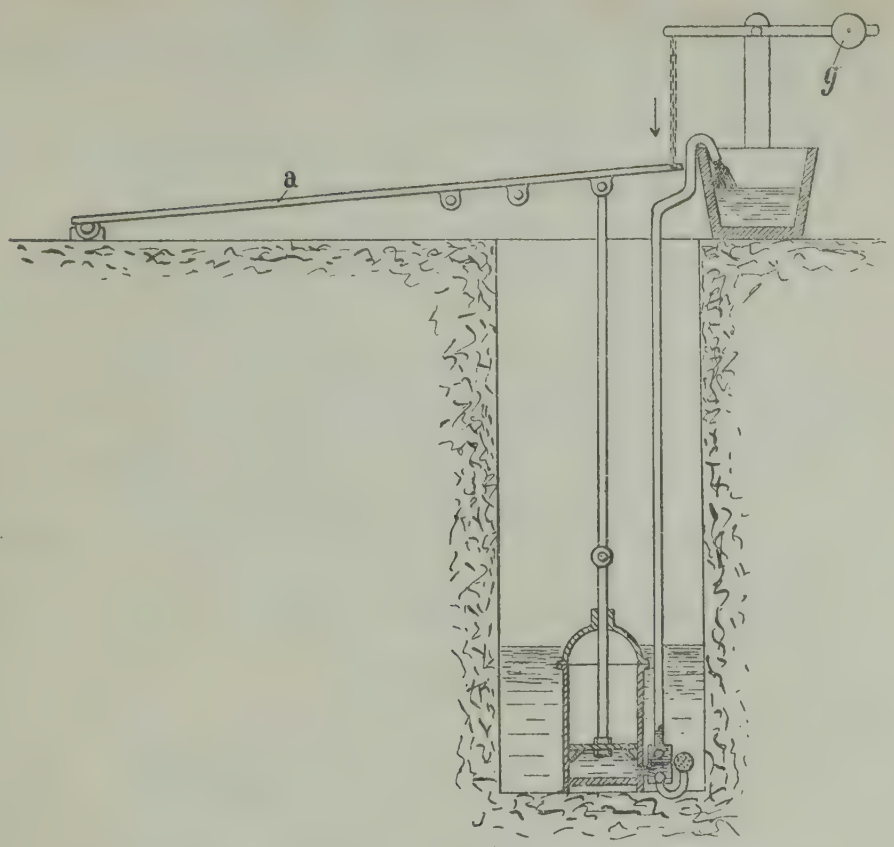
The accompanying figure is a sketch of an apparatus used for several years by the writer to remove dust while threshing. The screw-fan, *V*, rotating in front of the shakers, leads the dust into the pipes *a*, *b*, as shown by the arrows. The diameter of the fan and of the pipe *a* is about 40 inches, while that of the pipe *b* is only 24 inches. The moveable bent pipe, *c*, allows the action of the wind to be counteracted. The main pipe is about 15 ft. long and the dust can be driven a distance of 40 ft. The cost of the apparatus is from £16 to £20.



Apparatus for removing dust while threshing.

767 – **Pump for Watering Cattle worked by the Animals themselves.** — HINRICHS, in *Deutsche Landwirtschaftliche Presse*, Year XLI, No. 40, p. 500. Berlin, May 20, 1914.

This apparatus is designed with the object of saving the labour of pumping up water into the drinking troughs of pastures not provided with running water. The accompanying figure shows a section of the apparatus. The animal on mounting on the platform, *a*, starts the pump, which raises a certain amount of water. The counterweight, *g*, lifts the platform into its original position when the animal leaves it. A fence is placed round the apparatus to prevent its being used by more than one animal at a time.



Pump for watering cattle worked by the animals themselves.

768 – Review of Patents.

Tillage Machines and Implements.

Austria	65 192. Implement for removing weeds and the like from beet fields.
	65 386. Motorplough which can be used as a lorry or power engine.
	65 582. Clod-crusher.
	65 584. Turn wrest plough.
Belgium	264 420. Beetroot hoe.
Canada	152 930. Gang plough.
	152 969. Garden weeder.
	152 982. Motor plough.
	153 047. Land drag.
	153 079. Pulverizer, planter and weeder.
	153 081. Hoe and plough.
	153 103. Rolling drum plough.
	153 145. Land roller.
	153 165. Cultivator and weeder.
	153 180. Weeder for harrows.
	153 194. Plough beam.
	153 268. Weeder.
France	464 996. Motor plough.
	465 079. Machines for hoeing and singling beets.
	465 650. Rotary subsoil digger.
	466 103. System for fixing the moveable point of the plough.
	466 287. Apparatus for anchoring tillage machines, driven by portable engines, and advancing automatically as the work proceeds.

	466 490. Ploughshare with reversible edge.
	466 754. Hoeing and singling machine for horse or motor traction.
	466 841. Kneed cultivator tooth.
	466 855. Jointed ridging plough.
Germany	272 760. Motorplough, the front end of whose frame can be raised or lowered on the front wheel.
	272 819. Screw for ditching plough.
	272 844. Apparatus for driving ploughs by electromotor.
	272 787. Driving wheel with movable projecting cleats, for agricultural machines.
	272 877. Disk harrow with adjustable counter pressure disk.
	272 879. Plough with device for ploughing in green manure.
	272 947. Motorplough with one driving wheel.
	273 289. Two-furrow turnwrest plough with one plough on each side of the beam, thus balancing each other.
	273 377. Depth and inclination adjusting device for Flemish turnwrest ploughs.
Hungary	62 384. Motor rotary digging machine.
	62 399. New cultivator.
	62 448. Hoeing and ridging plough.
	62 470. Gang plough.
	62 503. Harrow.
	62 521. Motor gang plough with reversible motion.
	62 562. Self contained motor plough.
	62 604. Rotary cultivator.
	63 069. Rotary tilling machine.
	63 119. Driving wheel for agricultural machine, with cleats worked by an excentric.
	63 207. Device for raising or lowering plough shares.
	63 275. Weeding rake.
	63 341. Horse hoe.
	63 382. Steering gear for motor cultivator.
Italy	149 464. Device for balance ploughs to protect the headlands.
Switzerland	63 945. Toothed tilling machine.
	64 397. Ploughs.
	65 063. Motor fore carriage for ploughs in which the frame is beneath the axle of the side wheels.
	65 064 and 65 065. Machines for tilling the soil.
United Kingdom	28 234 and 28 288. Rotary power cultivators.
	28 391. Cultivator.
	28 861. Hoe blades for rotary hoe.
	29 210. Hand rakes.
	29 729. Agricultural ploughs.
	29 812. Digging machines.
	29 967. Cultivators.
	303. Motor cultivators.
United States	1 091 358. Cultivator.
	1 091 273. Revolving harrow.
	1 091 131. Zig-zag harrow.
	1 091 031. Subsoiler.
	1 090 935. Steering wheel for ploughs.
	1 091 681. Implement adjusting device for cultivators and the like.

1 091 712. Hand cultivator.
1 092 632. Rotary plough.
1 092 249. Disk harrow.
1 093 421. Steering device for cultivators.
1 093 786. Weed destroyer.
1 094 201. Land roller or pulverizer.
1 094 240. Plough.
1 094 277. Motor plough and planter.
1 094 196. Orchard plough.

Manure distributors.

Belgium 264 236. Mixing barrel for diluting and distributing cow dung.
Germany 272 948. Ratchet wheel and pawl drive for manure spreader.
Hungary 62 483. Manure distributor.
62 837. Liquid manure spreader.
Switzerland 65 293. Liquid manure cart.
United States 1 091 163. Fertilizer distributing attachment.
1 093 826 and 1 093 928. Fertilizer distributors.

Drills and sowing machines.

Austria 65 387. Potato planter.
65 581. Device for drills with sliding disks.
65 583. Dibbling mechanism.
Belgium 263 848. Beet drills.
Canada 153 280. Grain drill.
153 301. Corn-hill marker.
France 466 098. Sowing machine.
466 525. Drill.
Germany 273 171. Potato planter in which the potatoes are taken out of the hopper by revolving forks.
273 172. Sowing machine with unmoveable agitator wheels.
273 001. Tubes for potato planters.
273 291. Potato planter.
273 378. Potato planter with several tubes each with two slides.
Hungary 62 383. Improvements in dibbling machines.
62 441. Potato planter.
62 688. Seed pickling machine.
Italy 139 156. Drill.
Switzerland 65 469. Seeding apparatus with agitator wheels.
United Kingdom 28 290 and 29 967. Seed drills.
United States 1 091 068. Attachment for corn planters.
1 092 007. Marker mechanism for corn planters.
1 092 030. Corn planter.
1 092 358. Seeder attachment for gang and sulky ploughs.
1 093 991. Planting machine.
1 093 938. Transportable potato hole digging machine.

Reapers, mowers, etc.

Austria 65 774. Machine for hammering the blades of scythes.
Belgium 263 445 and 263 446. Attachment for mowers for arranging clover and other grasses in regular windrows.
263 684. Lawn mower with cutter-bar.

Canada	153 006-7 and 153 073. Harvester mechanisms.
	153 127. Harvester,
	153 132. Sheaf-loader.
	153 229. Harvester machine.
	153 250. Lawn trimmer.
	153 284. Lawn mower.
	153 302. Stacker mechanism.
	153 333. Grain carrier.
France	465 150. Improvement in the cutter-bar of mowers and reapers.
	466 298. Improvement in side delivery rakes convertible into tedders.
Hungary	62 496. Hay fork with wooden tines.
Italy	139 867. Device for mowers to prevent the knives from blocking.
Switzerland	63 947. Mower with reaping attachment.
	63 948. Cutter-bar for mowers.
	64 398. Machine for hammering scythes.
United Kingdom	28 578. Scythes.
	29 497. Harvesting machine.
United States	1 091 064. Hay rake and stacker.
	1 091 105. Knife arrester for mowers or binders.
	1 091 109. Corn topper.
	1 091 747. Corn harvester.
	1 091 779. Heading attachment for Kafir corn harvesters.
	1 092 721. Harvester.
	1 092 356. Grain stooker.
	1 092 722. Mowing attachment for motor vehicles.
	1 093 108. Harvesters for beans and the like.
	1 093 109. Kafir corn topper.
	1 093 742. Header and header binder.
	1 093 906. Shock-forming attachment for grain binders.

Machines for lifting root-crops.

Belgium	263 443. Improvements in toppers and lifters for beets and other roots grown in rows.
	263 480. Toppers for beets and other roots.
Canada	153 281. Potato digger.
France	464 872. Beet topper and lifter.
Germany	272 820. Potato harvester with tilting scoops.
Hungary	62 403. Beet topper.
	62 495. Steering gear for beet-root lifters.
	62 663. Potato lifter.
	62 950. Root lifting machine.
	63 377. Beet lifter.
United States	1 090 871. Beet harvesters.
	1 091 823. Beet topper and digger.
	1 092 216. Beet harvester.

Threshing and winnowing machines.

Austria	65 630. Device to prevent the straw from winding round the cylinder in threshing machines.
Belgium	263 042. Improved hand threshing machine for all cereals.
Canada	153 054. Threshing machine.
France	465 904. Straw elevator for threshing machine.

466 566. Group of machines for threshing and cleaning wheat.
467 058. Attachment for threshers to direct the straw or sheaf elevators.

Germany
273 198. Threshing machine with feed parallel to beater.
273 490. Self feeder for threshing machine.

Italy
134 812. Shaker with large screen for threshing machines.
139 357. Automatic device for counting sacks or measures for threshing, winnowing machines etc.
140 085. Straw elevator.

Switzerland
63 949. Dust-removing apparatus for agricultural machines and especially threshing machines.

United States
1 092 222. Threshing machine screen.
1 092 356. Grain stooker.
1 093 853. Grain separator.

Other agricultural machines and implements.

Austria
65 191. Tre felling and cutting machine.
65 269. Wheel especially for agricultural machines.
65 388. Turning and raking device for tedders and potato lifters.
65 772. Apparatus for watering live stock.

Belgium
263 285. Improved root-cutter.
263 491. Potato peeler.
263 572. Improvement in liquid manure pumps.
263 840. Centrifugal water purifier.
263 975. Filter for rain water.

Canada
153 091. Driving device for agricultural machines.
153 120. Device for extracting traction wheels from holes.
153 123. Stacker.
153 195. Well drilling machine.
153 252 and 153 290. Cattle guards.
153 286. Rake cleaner.

France
464 965. Fore-carriage for agricultural machines of all kinds.
464 983. Machine for composing buttons for marking animals.
464 999. Improvement in milking machines.
465 098. Double portable fodder press.
465 148. Device for untying animals in stables.
465 475. Traction sprayer.
465 867. Metal dismountable anti-hail rocket with safety device.
465 892. Apparatus for sulphuring vines and fruit trees.
466 249. Portable forcing bed built of reinforced concrete plates without angle uprights.
466 289. Leaf fender for beet root lifter.
466 579. Machine for removing outer bark for control of insects, etc.
466 770. Apparatus for destruction of injurious animals.

Germany
272 626. Appliance for use in manger.
273 003. Machine for shelling nuts.
273 005. Automatic lamp trap for insects with separate illuminating and catching surfaces.
273 151. Protective screen for chaff cutters.
272 999. Beet singling and potato lifting machine with throw wheel.
273 492. Vertical milk separator with vessel for skim milk.
273 199. Chaff cutting machine with device for automatic sharpening of knives while working.

	273 489. Cherry stoning machine.
Hungary	62 402. Agricultural tractor.
	62 527. Combined rake and elevator for straw, hay etc.
	62 577. Hay knife.
	62 606. Cleats for motor wheels.
	62 855. Wheel for raising and lowering agricultural machines.
	62 954. Chaff cutter.
	62 981. Ladder stay for fruit picking.
	62 982. Machine sprayer.
	63 030. Dust removing apparatus for agricultural machines especially threshers.
	63 093. Machine for untying sheaves.
	63 336. Appliance for cleaning fruit, seeds etc.
Italy	137 826. Device for untying animals.
	139 153. Sliding support for needle with elastic safety clutch for hay and straw balers.
	139 259. Wine pomace press with upward motion.
	139 261. Machine for extracting, at the same time, the essential oil and the juice of lemons, oranges etc.
	139 353. Pyramid-shaped continuous feed cereal esiccator.
	139 954. Improvement in hand sulphur dusting machines.
	139 961. Machine for husking dried chestnuts.
	139 719. Grape crusher.
	139 796. Fork for agricultural and industrial purposes.
	139 938. Soil injector.
	140 162. Double flower pot with compensating reservoir, porous inner wall and impermeable outside.
	140 254. System of protection against hail.
	139 598. Syringe for injecting liquids into cheeses while pickling.
	140 043. Machine for peeling chestnuts.
	140 171. Apparatus for peeling scalded almonds.
Switzerland	63 950. Apparatus for fumigating trees, etc. for control of pests.
	63 951. Process and apparatus for removing honey combs from hives.
	64 006. Apparatus for concentrating milk and other emulsions by filtration.
	64 007. Apparatus for washing and removing stones from wheat and other grain.
	64 008. Process and apparatus for grading and cleaning groats, grains, etc. by statical electricity.
	64 139. Grape cutting device.
	64 140. Honey separator.
	64 401. Sulphur duster.
	64 472. Milk separator.
	64 647. Window with device for catching insects.
	64 869. Animal dipping device.
	65 341. Appliance for suction milking machines.
	65 533. Milk sterilizer.
	65 666. Bee feeding box.
	65 725. Improved milking machine.
United Kingdom	28 527. Spraying machines.
	28 576. Machine for trimming plants and cultivating soil.
	28 584. Decorticating machines for Landolphia.

28 609. Apparatus for heating, cooling and drying grain.
28 657. Fruit stoning appliances.
28 671. Apparatus for pasteurizing milk.
29 009. Agricultural forks, welding etc.
29 123. Nut cracking machinery.
29 224. Cleaning sacks.
29 248. Cow milkers.
29 331. Apparatus for expressing liquids from fruits, herbs, flowers, etc.
29 369. Indiarubber coagulating apparatus.
29 635. Appliance for stoning cherries.
29 641. Apparatus for roasting, panning and drying tea.
29 648. Process of preparing peat as food for animals.
29 726. Lawn sprinklers.
30 067. Cow milkers actuated by the animal itself.
386. Extraction presses.
586. Potato peeling machines.
752. Agricultural syringes for injecting liquid manures, insect destroyers beneath the surface of the ground.
849. Apparatus for coagulating rubber latex.
916. Incubators.

United States 1 091 371. Attachment for wind driven pumps.
1 091 401. Spraying pump.
1 091 296. Bale tying mechanism.
1 090 860. Cranberry harvester.
1 091 952. Spraying machine.
1 091 587. Draught appliance for farming implements.
1 091 974. Milking machine.
1 091 990. Adjustable tongue.
1 091 912. Hay press.
1 092 376. Steering truck for traction engines.
1 092 762. Cotton harvester.
1 093 488. Draught tongues for agricultural machines.
1 092 865. Spraying device.
1 093 862. Wind mill .
1 093 904. Silo.

RURAL ECONOMICS.

769 – **The Statistical Method and its Value for the Economics of Farming.** — SAGAWE, B. in *Archiv für exakte Wirtschaftsforschung*, Vol. 6, Part 1, pp. 116-136. Jena, 1914.

In the first part of his work the writer discusses the different ways of collecting and working up material in the statistical and in the monographical methods and their advantages and disadvantages for showing the connection between causes and effects in general; he then passes on to the question as to which method is to be preferred and comes to the conclusions that in the study of productive farms (Erwerbswirtschaften), only by a combination of the two methods can the connection between causes and effects be estimated quantitavely and qualitatively in a reliable way.

In the second part of his work the writer treats of the importance of statistics in rural economy and of their application to research in this field.

The writer attempts by means of an example, to find out how far the several methods of isolating any particular factor to be examined attain their object, and analyses the effect of increasing intensity of culture upon the net returns. In this connection he examines: 1) an individual farm which, in the course of several years, evolved from extensive to intensive cultivation; 2) several variously organized farms during the same periods of time; 3) abundant material arranged according to the statistical point of view.

With the first method the period of observation, considering the variability of the weather and the consequent oscillation in the crops, must be extended to about 20 years. Then the most important factors to be considered are: position as regards means of communication, condition of prices, quality of the soil, capacity of the manager, which by their variation in the course of time render it almost wholly impossible to isolate completely the influence of the intensity of cultivation. When such is the case the result cannot be utilized as a term of comparison. The direction of the effect of individual factors can be recognized by separate monographs, but as soon as their quantitative effect is to be determined the method fails. The comparative monographic method encounters first of all the difficulty of finding suitable objects of comparison, for if even the so-called involuntary factors of production are fairly equal and comparable with each other, on the other hand it is impossible to eliminate the influence of the voluntary factor, the manager of the farm. Consequently it will also be impossible to attain correct numerical conclusions. The comparison of individual farms may afford a general view of the effect of the various factors, but in order to calculate with precision their influence and to obtain comparable figures available in practice, the formation of groups must be resorted to, that is to say the statistical arrangement of the data.

The use of the statistical method presupposes the existence of abundant material. But even not very abundant material can be utilized statistically, because with suitable methods of compensation a relatively large number of groups can be formed. In conclusion, the writer shows by a practical example how the isolation of a factor can be carried out under some circumstances without forming sub-groups. He calculates the effect of the increasing intensity of cultivation on net returns in 88 farms affiliated to the book-keeping office of the D. L. G. (German Agricultural Society).

In the formation of groups connected with each other, according to the compensation method of Prof. Mitscherlich of Königsberg, all the factors are fairly compensated with the exception of that of soil quality. The writer calculates the effect of the varying quality of the soil upon net returns, and basing his calculations upon the difference between the net returns obtained in this way and those obtained by grouping the farms according to the increasing intensity of cultivation, he shows the influence of this factor upon net returns.

770 – **Principles of Exact Investigations in Agriculture.** — Von Koppen, Wilhelm in *Archiv für exacte Wirtschaftsforschung*, Supplement 13, 88 pp. Jena, 1914.

After giving some general information on the importance of agricultural bookkeeping and on the difference between the bookkeeping of financial institutions and of commercial firms, the writer treats with more detail the notion of " net returns ", about which a certain confusion has often been made between the means and the end ; in defining it also the technique of some particular method of bookkeeping has been too frequently used, instead of explaining the result of calculations. A general definition of net returns must satisfy all methods of bookeeping. The writer proposes the following : " Net returns are the numerical expression of the economic result of a farm free from debts. "

Every system of agricultural bookeeping which calculates net returns in such a way that they correspond to this definition must be considered systematic.

The most valuable system of bookkeeping is that which answers best to the requirement of the farm manager and to the character of the farm. The writer considers the systematic opening of accounts as the simplest and surest way of recognizing the direction and organisation of the farm. Systematic bookkeeping or bookkeeping by double entry must first of all show the various branches of the farm in such a way as to allow of the sufficient examination of each branch-organ and to recognize its function towards the other branches and towards the whole farm — the organism. Lastly bookkeeping by double entry must allow the cost of production to be exactly determined.

The system of bookkeeping introduced by the writer in his farm is called by him farm bookkeeping by groups. In his method the ledger is arranged under the form of accounts, with an auxiliary book in the form of tables.

The divisions of the whole farm into a small number of groups of accounts avoids the danger of totally separating the various production branches from the complex of the whole farm and renders the examination of each branch and of the reciprocal connection between them easier. On the other hand the decomposition of each group of accounts according to the system of tables by means of auxiliary annexes allows of a very detailed division of the farm and of the grouping together of the similar items of accounts, in view of a very minute control, of systematic calculations and of statistical observations, without causing the slightest perturbation in the whole of the farm.

In the bookeeping by groups adopted by the writer the agricultural production is divided into two groups only : crops and productive stock. The utilization of the soil (crops) is considered as a whole. It is the same with the maintenance of productive live stock, which includes milch cows, young cattle and foals, as well as pigs and sheep if kept. Against these two accounts of production are placed the expenditure accounts, chief among which is that for labour, comprising all the labour expenses. Among the items of outlay there are the produce that is consumed and

general expenses. The first contains all the stores bought in, so far as a control over the remaining stock appears necessary. All the other expenses are found together in the general expenses account, which may be subdivided again as required. Lastly there are the inventories and the closing accounts.

The prices given to the produce sold are the market prices, upon which are based those of the produce consumed in the farms itself. In order to take into due consideration the rise and fall of the market prices, the writer uses a table of calculations relating to the produce of all kinds consumed on the farm. This table is an indispensable auxiliary in bookkeeping by groups, and it must be posted up every four weeks so as to follow closely the changes in market prices. Besides the prices, the quantities also must be carefully determined.

Of course, as in all bookkeeping, the accounts begin by an inventory and balance-sheet containing all the necessary information on the assets and liabilities. The items concurring in an increase of capital are entered as follows : The cultivable soil, having a lasting value, is inventoried at its cost price ; permanent improvements likewise, while improvements possessing only a temporary duration are written off proportionately to their duration. The farm produce utilized in the farm itself, for instance timber for building purposes, is entered at the sale price obtainable at the farm. New plantations of trees are treated according to the same principle as cultivable land. The cost of the work of preparing the land for the crops, such as sowing, the seeds sown and the manures, must also appear in the inventory ; only when an inventory contains these data can the profitableness of the various crops and the cost of their production be ascertained.

Following upon this somewhat general discussion, the writer explains how he deals in the inventory with the various assets and liabilities, such as soil, forests, fruit plantations, improvements, roads, buildings, machinery, live and dead stock, cash, credits and debts, etc.

After entering these various values in the inventory, they are grouped together in the balance sheet and the total capital is worked out. The ledger is opened on the basis of the balance sheet. For technical reasons it is advisable to open the accounts of the ledger only at the end of the year. During the course of the year the farmer can limit himself to the entering of all business and farming events in chronological order in his memorandum book and to drawing up his table of stores every four weeks. The memorandum books must group the figures as they are to be used in the ledger.

The writer distinguishes two kinds of memorandum books :

A. Those referring to business transactions.

B. Those dealing with the work in the farm itself. The first group includes : the business journal with cash book, the labour book, the petty cash book, etc. as well as the current account book.

The second group includes the farm day book, with forage and milk tables as auxiliaires, the stores and livestock account, and the principal labour book.

At the end of the year the inventary has to be posted up to date and the closing balance sheet prepared, but it cannot be closed until the value of the stores and of the work put in the ground for the standing crops has been determined.

The next steps are to close the memorandum books, to start the ledger accounts and to close : 1) the auxiliary accounts, 2) the cash and inventory accounts, 3) the general expenses accounts, 4) the stores and 5) the labour accounts. After this, production accounts proper are closed. The first of these is the crop account, which must be divided into two parts : " production " and " utilization ". Then comes the productive stock account and last of all the forest account.

After this there remain the other auxiliary and closing accounts : 6) the household and personal expense account, 7) the profit and loss account, and 8) the capital account.

771 – **Giving Farm Labourers a Personal Interest in their Work.** — Schulze Georg, in *Landwirtschaftliche Jahrbücher*, Vol. XLVI, No. 1, pp. 44-88. Berlin, 1914.

An enquiry was made into the means adopted on a number of large farms for giving all hired labourers as well as managers a personal interest in their work. Such means will naturally differ according to the nature of the work involved, but take the general form of payment by piecework and of bonuses in the case of stockmen. The writer discusses the advantages of large holdings in many styles of farming and the possibilities of adding to these advantages that personal interest in the work which is such an important factor in obtaining the best results. A bibliography is appended, together with a copy of the question form sent to the farmers.

772 – **Piece-Work in German Farming.** — Esden-Tempski K., in *Landwirtschaftliche Jahrbücher*, Vol. XLVI, Part 3, pp. 455-498. Berlin, 1914.

The object of this paper is to illustrate the principles followed in fixing payment of piece-work in farms. For this purpose wages in kind must be considered as well as wages in cash.

Farms in Germany employ three kinds of labourers.

1. Labourers under permanent engagements.
2. Labourers under temporary engagements.
3. Casual labourers.

The first two classes get respectively two-thirds and one-third of their wages, in kind and the rest in cash, while the third class is paid only in cash. Assuming that for work of the same value the total wages are the same, the payment in cash is lowest for the permanent hands, somewhat higher for the temporary ones and highest of all for the casual labourers.

In practice this arrangement leads to the result that those labourers who should have the greatest interest in the prosperity of the farm get the least profit from piece-work, while the other two classes are better paid.

That such is the case is proved by a practical examples. On a farm in the province of Brandenburg the wages per day in summer are the following :

Permanent labourers	8*d*
Temporary »	1*s* 1*d*
Casual »	2*s* 0*d*

Usually the wages of the casual labourers or strangers are considered as the price of labour in the locality. Assuming such to be the case, namely that the men get a daily total wage of 2*s* then the value of the wages in kind per day is:

Permanent labourers	1*s* 4*d*
Temporary »	11*d*
Casual »	—

In this farm the payment of piece-work is fixed according to the wages in cash. Taking the daily wages at 8*d*, 1*s* 1*d* and 2*s* as the piece-work payment of one day's work, then the earnings of the three classes of labourers, 1) at daily wages, 2) at piece-work pay doing twice as much work, and 3) at piece-work doing three times as much work (all calculated for 140 summer days) work out as follows:

	I Daily wages			II Piece-work doing twice as much work			III Piece-work doing three times as much work		
	£	*s*	*d*	£	*s*	*d*	£	*s*	*d*
Permanent labourers:									
in cash	4	16	1	9	12	2	14	8	3
in kind	8	18	5	8	18	5	8	18	5
Total earnings	13	14	6	18	10	7	23	6	8
Temporary labourers:									
in cash	7	11	0	15	1	11	22	12	11
in kind	6	3	6	6	3	6	6	3	6
Total earnings	13	14	6	21	5	5	28	16	5
Casual labourers:									
in cash, total earnings	13	14	6	27	9	0	41	3	6

The casual labourer has thus an advantage over the permanent labourer in case II of £8 18*s* 4*d* and in case III of £17 16*s* 8*d*. His greater profit in case II is equal to the value of the payment in kind that the more permanent labourer receives and which is not considered in the piecework payment of the latter. Every further increase in the amount of work done is so much more profit to the casual labourer. This signifies that the piece-work wages of the permanent labourers, even when he is, as capable as the casual labourer, are always inferior to those of the latter and to a less extent to those of the temporary labourer.

If instead of taking only the wages in cash as a basis for the payment of piece-work, the total of cash and kind were taken, all three classes of labourers would be paid on the same basis of 2*s per diem* and the wages for all three would be :

I	II	III
Daily wages	Piece-work doingt wice as much of work	Piece-work doing three times as much work
£13 14*s* 6*d*	£27 9*s* 0*d*	£41 3 6

But as the permanent and temporary labourers also get payment in kind, this must be deducted, otherwise they would receive it twice. After this subtraction the three classes would be paid as follows :

	I Daily wage			II Piece-work doing three as much work			III Piece-work doing three times as much work		
	£	*s*	*d*	£	*s*	*d*	£	*s*	*d*
Permanent labourers:									
Total earniugs:	13	14	6	27	9	0	41	3	6
Wages in kind	8	18	5	8	18	5	8	18	5
Wages in cash.	4	16	1	18	10	7	32	5	1
Temporary labourers:									
Total earnings	13	14	6	27	9	0	41	3	6
Wages in kind	6	3	6	6	3	6	6	3	6
Wages in cash	7	11	0	21	5	6	35	0	0
Casual labourers:									
Wages in cash, total earnings . .	13	14	6	27	9	0	41	3	6

Thus the daily wages of the three labourers are the same in all cases. Only the amount in cash varies, and the difference is equal to the value of the wages in kind counted once.

From the above the conclusion may be drawn :

1) That the calculation of piece-work must not be based only on the cash wage but on the total wages in cash and kind.

2) That from the total wages the amount given in kind must be subtracted.

Only piece-work paid according to these principles will keep labourers in the country, whilst the system hitherto followed has done much to drive labourers away form the country, as it has been more unfavourable to the permanent hands than to the temporary and casual ones.

773 – **Reclamation and Improvements in the Roman Campagna** (1). — VERRATTI, S. in *L'Italia Agricola*, Year LI, No. 5. Piacenza, May 15, 1914.

A first Commission was appointed in 1870 to report on the measures necessary for reclaiming the Roman Campagna, and in December 1878 a law was passed declaring the proposed reclamation to be of public utility and that the State should undertake the draining of the principal marshes, while landowners should be compelled to do the subsidiary canalization; further, the law decreed that the zone of reclamation was to extend in a circle with a radius of 10 kilometres (6.3 miles) from the Milliarum Aureum in the Roman Forum. In July 1883 an additional law was passed enabling the Government to expropriate the owners of land in the given zone should they refuse to play their part in the scheme of reclamation, but as serious outlays were imposed on the landlords without a prospect of anything like adequate returns, and, further, as the expropriation would have involved the State in far too great an expense, the law was applied in three cases only and was then left aside. A new law was finally passed in December 1903 (No. 474), which, together with that of 1883, constitutes the combined law of November 10, 1905 (No. 647), which is still in force.

This law confirms the obligation to reclaim the land in the zone mentioned above, and in that part of the basin of the Aniene which is comprised in the Roman Campagna, with the provision that owners not wishing to conform should have their land sold by public auction, the purchaser undertaking to carry out the necessary improvements. Landlords or purchasers might receive, besides other pecuniary advantages, a loan from the Ministry of Agriculture at 2 ½ per cent, repayable in 45 annual instalments, beginning after the fifth year of the loan, such loans, which might amount to £80 000 per annum, to be furnished by State funds. Even if done by private initiative, three-tenths of the expense of making the subsidiary canalization was to be contributed by the State, the Province and the Commune. With regard to the construction of new roads required by the scheme, these were to be approved by the Ministry of Public Works, and the expense of construction shared equally by the Government and by the Commune, their upkeep being left to the Commune.

A special Commission made up of 11 members was formed to attend to the application of the law and to investigate technical and administrative questions to which it might give rise.

A further law dating from July 1910 (No. 491) comprises some addi-

(1) Throughout this article, "Roman Campagna" is used as a translation of "Agro Romano", that is the territory belonging to the Commune of Rome, and not in the more general sense of all the country round Rome. The Agro Romano includes two very distinct types of country: 1) a flat belt along the coast, originally marshy, including the reclaimed areas of Maccarese, the Isola Sacra, Ostia, etc.; 2) a plain at 200-400 ft., furrowed by streams which mostly only run in rainy weather, and largely under pasture (dry for three months in summer) or temporary grain cultivation: to this second part colonization rather than reclamation applies. (*Ed.*).

tional measures for reclaiming the Roman Campagna, which may be summarised as follows :

1) *Application of measures laid down in the law of* 1905 *to land situated beyond the zone originally fixed upon.* — By a Royal Decree it was made possible to extend the application of the measures to land outside the given zone in certain cases where the general condition of an area or the desire to encourage private enterprise made it expedient to do so.

2) *Necessity to encourage the formation and development of centres of habitation in the reclaimed area.* — To this end it was decided: *a*) that all centres of colonisation consisting of at least 25 families established within ten years of January 1, 1911, and at a distance of at least 5 kilometres (3.1 miles) from the boundaries of Rome, should be exempt from all rates and taxes, local or governmental, during a period of 20 years ; *b*) that anyone proposing to establish such a rural centre of habitation and not having the necessary building land, might apply to the Ministry in order to be supplied with the land by expropriation for the public good ; *c*) that all private or public enterprises, including those started by owners, with the object of establishing rural colonies should be assisted by a loan at 2 ½ per cent. repayable on the terms mentioned above ; and *d*) that the sum required for such loans should be provided by State funds, the total amount being limited to £40 000 per annum beginning from July 1, 1910.

3) *Encouragement of live stock* — The State associated itself with the Province of Rome for the establishment and upkeep of an Institute (Istituto zootecnico laziale) whose duty it is to distribute high class breeding stock suitable to the district, and to encourage the production of forage crops, dairying, etc.

4) *The provision of adequate financial means without creating new charges on the State.* — An independent fund was started known as the " Cassa di colonizzazione per l'Agro Romano " which draws its revenue from the following sources : *a*) one-tenth of its own net annual profits ; *b*) all sums become available by repayment of capital invested before 1910 or any balance left over in the special budget of the Ministry of Agriculture concerning the reclamation scheme ; *c*) other contributions.

With this fund the Minister of Agriculture will provide prizes and subsidies to encourage useful initiative and especially for making farm roads, providing water supplies for drinking and irrigation purposes, building cottages and other kinds of improvement.

5) *Modifications in certain articles of the law of* 1905. — The period fixed for obtaining the contribution of 30 per cent. from State, Province, or Commune towards canalization works was proroged to December 31, 1915. The Government was authorised to connect up the farm roads with train or railway stations, where necessary.

Some of the results obtained by the application of the law are given below :

Drainage works carried out by the State. — Of 34 600 acres which are estimated to require draining, about one half have already received attention; large drainage operations have been carried out at Ostia (4686 acres), Isola Sacra (637 acres), Maccarese (10 668 acres), and smaller ones at the Lake of Tartari, in the low ground of the Almone, in the marshes of Straccia-cappe, Baccano and Pantano, some of which have already been handed over to associations for management. Up to June 30, 1913, the State had spent about £260 000 on the enterprise. At that time it was estimated that another £80 000 would be required to complete the work, including the running expenses of the machinery for another five years and certain operations to be carried out on the coast between Pratica and Anzio.

The drainage of the Isola Sacra and Maccarese cannot be said to have had practical results in so far as cultivation is concerned, as they both

consist of grazing land over which cattle are allowed to range, and their hygienic condition is not very satisfactory. These areas have recently been brought into the zone of obligatory reclamation.

Drainage Associations. — In April 1912 the 91 Drainage Associations amalgamated to form one central society, which is to reorganize the whole system and undertake the management from a single centralized office, directing all the work and receiving all contributions. A committee made up of delegates from the various constituent societies has already drawn up a scheme of organization for the central office and another relating to the contributions to be paid by the various units. This has already been approved by the general meeting of the delegates and is now only waiting for the approbation of the Ministry of Public Works before being put into practice.

Contributions to subdidiary canalization. — The contribution of 30 per cent. from the State, Province and Commune towards expenses of making the subsidiary canals on the various estates has been granted in twenty holdings at a cost of about £12 800, while grants amounting to £12 000 are being made for six other holdings now carrying out similar work.

Road making. — The law of 1905 provided for the construction of 250 kilometers (156 miles) of roads, but of these only 30 km. (19 miles) have as yet been accomplished at a cost of £41 200, while another 10 km. (6 miles) are being built at a cost of £15 000 and 29 km. (18 miles) are planned at an estimated cost of £60 000.

As the city of Rome has extended, roads which were originally considered to form part of the reclamation zone have been taken over by the city, while the extension of the zone beyond the original limits has increased the number of roads fixed upon in the original plan approved by the Ministry of Public Works in 1905, and for these reasons a Commission has been appointed to modify the original plan. The revised plan is now being passed by the Ministry and provides for 250 kilometers of roads, and above those already in course of construction, at a cost of £460 000 over. Of this it is expected that £180 000 will be spent during the next four years for the building of 100 kilometres (62.5 miles) of road.

Agricultural improvements. — Of the 500 000 acres which constitute the whole Roman Campagna, 175 000 acres have been subjected to compulsory improvement, of which 112 000 acres excluding the suburbs make up the zone fixed by the law of 1903. Of this latter area, 6400 acres are already improved and 54 300 acres are in course of improvement, the remaining 51 000 acres being for the present almost untouched as the "Commissione di vigilanza per l'Agro Romano" admit the great difficulty of carrying the law into effect in all cases. Nothing has yet been done in those areas brought within the limits of the zone in 1910.

Loans. — The adjoining table shows the distribution of the annual grant of £80 000 from the central State bank for loans in connection with agricultural improvements; in ten years about £520 000 have been distributed.

Distribution of loans granted by the Ministry of Agriculture for improving the Roman Campagna.

	1907-08	1908-09	1909-10	1910-11	1911-12	1912-13	1913-14 (1st half year)	Total for the period	
	lire	lire	lire	lire	lire	lire	lire	lire	
New cottages	292 166	791 725	1 345 376	512 884	881 000	107 804	60 209	3 991 164	(£159 646)
Old cottages repaired	15 373	138 080	187 200	248 217	94 140	159 000	24 000	866 010	(£34 640)
Farm buildings	358 983	804 640	926 639	898 923	1 273 860	215 836	71 041	1 549 922	(£61 996)
Farm roads	77 230	124 100	358 930	185 020	246 019	39 050	11 350	1 041 699	(£47 668)
Land drainage	22 400	47 245	86 255	110 132	248 085	127 000	13 800	654 917	(£26 196)
Breaking up land	24 502	11 750	69 510	23 500	56 405	7 000	550	193 217	(£7 728)
Water supply	28 700	20 560	174 336	256 766	242 305	35 200	266 968	1 024 835	(£40 993)
Plantations	91 455	70 485	140 307	144 803	93 820	8 130	—	549 000	(£21 960)
Other operations	52 441	49 250	44 847	117 055	90 760	17 765	16 651	388 769	(£15 550)
Total each year	963 250 (£38 550)	2 057 735 (£82 313)	3 333 400 (£133 336)	2 497 300 (£99 892)	3 226 394 (£129 035)	716 785 (£28 671)	464 569 (£18 582)		

774 – **Bookkeeping Results: Five-Year Averages obtained at the Accountants' Office of the German Agricultural Society.** — STIEGER. — *Arbeiten der Deutschen Landwirtschafts-Gesellschaft*, Part 255, pp. 87 + 4 tables. Berlin, 1914.

Two years ago Part 180 of the *Arbeiten der D. L. G.* gave the principal average results of five years of bookkeeping in the farms affiliated to the accountants' office of the German Agricultural Society (D. L. G.); these averages are now published annually.

The present work contains the average results of the books kept in 114 farms, classed according to the different regions of the country, for the years 1907-08 to 1911-12. In order to compare these data with each other and to exclude those of the abnormal year 1911-12, the writer adds the averages of the five years 1906-07 to 1910-11 for 103 farms which bear the same numbers in both synopses.

These data are given in the form of tables which contain 71 columns, as follows :

Column 1 : number given to each farm (repeated in column 71.).

Column 2 : group to which the farm belonged according to its extent.

Column 3 : distance of the farm from the nearest railway station.

Column 4 : net returns as ascertained for the purposes of the land tax, given as indications of the quality of the soil.

Column 5 : total value of the farm, which in 48 cases is the value of the farm as established in order to fix the amount of the complementary taxes, in 10 cases the net returns as per land register multiplied by 75, in 14 cases the real purchase price, in 2 cases the value estimated by the " Landschaft " (a Prussian credit institution), in 9 cases the rent capitalized at 3 per cent. plus the value of the live and dead stock, and in 27 cases the value as estimated by the owner himself.

Column 6 : capital invested in buildings
Column 7: capital in machinery and implements
Column 8 : live stock
} According to inventory

Column 9 : total live and dead stock in percentage of the whole value of the farm.

Column 10 : total live stock in head of large cattle per 100 hectares (247 acres) of cultivable area.

Column 11 : total draught animals in horse units.

Column 12: number of draught animals per 100 hectares (247 acres) of cultivable area.

Columns 13 to 20 : the various crops (13, meadows ; 14, permanent pastures, both in percentages of the whole cultivable area ; 15, winter cereals; 16, spring cereals ; 17, pulse crops ; 18, hoed crops ; 19, forage crops ; 20, bare fallow, (all in percentages of the arable land).

Columns 21-26 : yields in weight of the six most important crops (wheat, rye, barley, oats, sugar-beets, potatoes).

Column 27 : average milk yield per cow and per ration-day.

Column 28 : sale price of the milk.

Column 29 : total yield of the farm ; that is, besides the returns from the sale for cash or credit of the produce, also the value of those articles

supplied to the owner and the increase in value of the inventory at the end of the year.

Column 30 : total outlay ; that is the total working expenses wages, insurance, outlay other than in cash, such as wear and tear and depreciation of farm implements and other capital, and the decrease in value of the inventory at the end of the year as compared with that at the beginning.

Column 31 shows the difference between the items in columns 29 and 30, which represents the net returns of the farm free from debts, rent or other charges. The net returns per unit of area afford a clear expression of the absolute result of the farm ; but if this is to be estimated at its just and full value, it must be examined in connection with other data concerning the same farm. Thus, for instance, the best net return is that obtained with the least expense in the course of the year.

Column 32 : shows the amount of expense per unit of net returns. In comparing the results of several farms this figure is not sufficient measure of the success of the farm because it does not take into consideration the value of the farm, and of two farms which, with the same yearly outlay, get the same net returns, the one with the least capital value is to be considered the better managed of the two.

Column 33 shows the net returns expressed as percentage of the value of the farm, that is the interest on the total capital. This figure does not consider the year's expenses, and it is evident that of two farms the net returns of which give the same amount of interest on the total capital, the more successful one is that which obtains this result with the least expense. It thus becomes necessary to take into account the year's expenses as well as the interest on the value of the farm. The easiest way to do so is to add these two quantities together in order to get the total expenses and to obtain the ratio of the net returns to this sum.

Column 34 shows the actual amount of the 4 per cent. interest per unit of surface ; then, after having added together, for each farm, the figures contained in columns 30 and 34 in order to have the total amount of expenses, all that remains to be done is to divide by this number the net returns multiplied by one hundred, in order to get the desired number which shows the amount of net returns obtained per cent of total expenses. This figure is found in Column 35.

Column 35 : this figure affords the best possible base for judging the quality of the management of a farm from the point of view of profitableness. The writer calls it the " fundamental number " (Kernzahl).

Columns 36 -41 : amounts of the chief partial receipts in cash.

Column 42 : total amount of cash receipts.

Columns 49 - 60 : these give the farm expenses (60, the total amount, 49-59 the principal partial amounts).

In Columns 43-48 and 61-70 the quantities contained in columns 36-41 and 49-59 are repeated, but expressed respectively in percentages of the total amount of receipts and in percentages of the total amount of expenses.

The writer gives the averages of the interest obtained by these farms

during the years 1907-8 to 1911-12, first all together and then grouped according to provinces. He then endeavours to determine the influence of the quality of the soil, represented by the amount of the net returns according to the land register, on the economic results of 18 farms in the province of Silesia, and of 21 in the province of Brandeburg. The farms are arranged according to the land register net returns and the writer indicates for each farm: the yield of the crops per unit area, the net returns, the fundamental number (Kernzahl), the outlay for the purchase of artificial manures, the receipts from productive live stock, and the ratio between the areas under the various crops. If for the 21 Brandeburg farms, the first half with average land register net returns of 6*s* 3*d* per acre be compared with the other half with average land register net returns of 3*s* 5*d* per acre, higher effective net returns will be obtained for the first group than for the second (£ 1 0*s* 5*d* against 11*s* 5*d*), although the returns from the various farms taken separately differ considerably. The same result is obtained with the Silesian farms, the two groups of which show respectively land register net returns of 10*s* 7*d* and 4*s* 2*d*, and effective net returns of £ 1 9*s* 11*d* and 10*s* 10*d* per acre. In the same way the fundamental number of the Silesian farms, which is for the two groups 24.80 and 11.56, shows that the better quality of soil allows results to be obtained more economically. The difference between these two numbers is considerably less in Brandeburg (15.21 and 12.24).

At the end of his work, the writer calls attentions to the great importance of the value of the farm for all discussions on the management and organization on numerical bases, and on the necessity of a clear understanding as to this value and to the exact method of determining it.

AGRICULTURAL INDUSTRIES.

INDUSTRIES DEPENDING ON PLANT PRODUCTS

775 – **The Electric Field in the Maturation of Wine.** — NITESCU, MARCEL A. in *Revue de Viticulture*, Year XXI, No. 1068, pp. 621-624. Paris, June 4, 1914.

Wine is a good electrical conductor because of the acids and salts it contains, and it has been subjected to the influence of an electric field by CH. HENRY in order to bring about sterilization and maturation. The electric field employed is continuous and of high tension (100 000 volts) but of low intensity, so that the wine should be decomposed as little as possible, though suspended matter and colloids are sufficiently electrified to move towards one of the poles, where they can easily be eliminated. At the same time the invertion of sugar is prevented, and it is thus possible to treat wines attacked by injurious ferments such as "graisse" or "casse".

The Henry method makes it possible to control the process by stopping it as soon as the samples drawn from taps close to the poles have the same flavour as those drawn from the bung hole. The movement of the colloids in the liquid has the further function of constantly stirring the large reaction surface presented by them and thus accelerating their catalysing action.

The different wines, brandies and kirschs which have been treated, yield, besides an appreciable increase of volatile esthers, the various maturation indices which are usually observed as the result of the action of the more slowly working enzymes.

776 – **The Alcohol Content of Yeast.** — FOTH, G. in *Jahrbuch des Vereins der Spiritusfabrikanten in Deutschland*, Vol. XIV, p. 33. Berlin, 1914.

A series of determinations was carried out in the Laboratory of the Society of German Distillers in order to investigate the alcohol content of yeast under various conditions. The results are as follows :

1) The alcohol produced by the fermentation of sugar solutions is not all found in the solution; part is retained by the yeast. Moreover the amount of alcohol in both yeast and solution, stated as per cent. of alcohol + water in both cases, is practically the same and this fact holds good in both weak and strong sugar solutions (10 to 20 per cent.).

2) If yeast be washed to remove the alcohol it contains and then put into a solution containing alcohol, it will absorb alcohol until equilibrium is established between the yeast and the solution.

3) If yeast be left in alcohol solution, the alcohol content of both yeast and solution diminishes owing to assimilation of part of the alcohol.

4) The content of compressed yeast in both water and alcohol increases with the time of keeping, while glycogen disappears simultaneously, from which it would appear that the increase in water and alcohol is due to the decomposition of the glycogen. Moreover the amount of alcohol thus formed is considerably less than the amount expected by the fermentation equation.

777 – **The Use of "Phosphogelose" in Brazil.** — PELLET, H. in *Bulletin de l'Association des chimistes de sucrerie et de distillerie*, Vol. XXXI, No. 11, pp. 849-858. Paris, May 1914.

The "phosphogelose" process in the manufacture of sugar consists in the addition of a mixture of bicalcic phosphate and kieselguhr to the juice previously treated with lime, the object being to help clarification and to obtain a scum of manurial value. The composition of two such scums was as follows :

	Per cent.
Water	43.56 to 43.23
Organic matter	26.32 to 27.67
Total phosphoric acid	8.41 to 9.85

The process is at present in use in a few sugar factories in Bahia.

778 – **The Reduced Gluten Content of Flour.** — BALLAND, J. A. F., in *Comptes rendus des séances ds l'Académie des Sciences*, Vol. 158, No. 16, pp. 1103-1106. Paris, April 20, 1914.

For some time the Paris bakers have complained that flour requires less water than it did formerly to work up into dough. Analyses from the laboratory of the Bakers' Syndicate show that more than half of the flours examined during the month of February, 1914, contained less than

7.5 per cent. of dry gluten or 22.5 per cent. of moist gluten, a quantity which is considered insufficient to obtain the best results in breadmaking and which is generally attributed to degeneracy of the wheat owing to intensive culture.

From 1869 to 1880 the mean annual content of moist gluten in high class flours from twelve milling firms varied from 27.53 to 30.34, with an average of 29.1 per cent., or 9.7 per cent. of dry gluten. From 1881 to 1895 the figures range from 23.44 to 26.84, with an average of 25.1; during the last ten years (1905-1914) they were further reduced to 21.1, 26.8 and 24.7 respectively. Inferior quality flours frequently only contain 7.5 per cent. of dry gluten.

Although these data are not absolutely comparable owing to the introduction of foreign wheat, they would indicate that since roller mills have supplanted the grist mills, flour has reduced its dry gluten content by 2.2 per cent., that is, every kilog. of flour has lost 22 gms. of protein, which is equivalent to the amount contained in 110 gms. of butcher's meat. On examining the seasonal and regional yield, it was concluded that this loss of gluten is not due solely to degeneration of the wheat, but also to climatic variations and to the new methods of milling which eliminate the germ and those portions of the wheat grain which contain most nitrogen.

INDUSTRIES DEPENDING ON ANIMAL PRODUCTS

779 – **International Union of Municipal Dairies.** — *Molkerei Zeitung*, Year 28, No. 49, pp. 944-945. Hildesheim, June 26, 1914.

On the occasion of the Sixth International Dairy Congress, at Berne, was held the first general meeting of the recently founded International Union of Municipal Dairies, a large number of municipal dairy enterprises bring represented. Stockholm was selected by the meeting as the headquarters of the Union, which has for its object the general advancement of municipal dairying and the advising of its members as to methods of improving their business.

780 – **The Supply of Milk to Indian Cities.** — MANN. H. H. (Agricultural College, Poona) in *The Agricultural Journal of India*, Vol. IX, Part 2, pp. 160-177. Calcutta, April 1914.

An account is given of the milk supply of Poona, this being fairly representative of the conditions existing in several other Indian cities. The milk is produced partly in the city itself and partly in 47 neighbouring villages which send in about 550 galls. per day; of this :

21	per cent.	comes from	villages within a radius of less	than 3 miles
48	»	»	»	3 to 6 »
28.5	»	»	»	6 to 9 »
2.5	»	»	»	over 9 »

Practically the whole supply is brought in by hand in brass pots slung over the shoulders or carried on the heads of the milkmen, bullock carts or the train being only used in a few cases. Nine-tenths of the total consists of buffaloes' milk, whose content of fat and solids-non-fat amounts to 5 and 9 per cent. respectively, as against 3 1/2 and 8 1/2 per cent. in cows' milk.

Of 51 samples collected at the entrance of the city only 10 were pure, even when judged on a very conservative basis, the remainder being adulterated with more than ten per cent. of water. The price varies with the quality, there being a close connection between the price and the amount of water added; for instance all milk sold at less than six seers for one rupee (1s 1*d* per gallon) is almost certain to be adulterated. With regard to the amount of dirt it contains, this is not nearly so great as would be expected; of the 51 above samples:

56.7	per cent.	were	clean or nearly clean
33.3	»	»	fairly clean
7.8	»	»	distinctly dirty
1.9	»	»	very dirty

The milk produced in the city itself is a far more important contribution to the total supplies than that brought in from the surrounding country. The milking cattle of the city consist of 2 688 head, of which 1532, or 57 per cent., are kept for private use only and 1156, or 43 per cent., for sale of the milk. Among the former class about three-quarters consist of cows and the remainder of buffaloes, while in the latter class the proportions are reversed. The cattle kept for the sale of their milk are housed in small sheds distributed all over the city; 80 per cent. of these sheds contain less than ten animals, and their general conditions of hygiene are very bad. It is estimated that about 2 000 gallons are produced daily, of which about 1 400 gallons are buffaloes' milk and the rest cows' milk; the total daily consumption in the city therefore amounts to 2 550 gallons per day.

The writer discusses schemes of reform for the city milk supplies and advocates the establishment of large dairy farms outside the city, where the animals would be in cheap and natural surroundings, and the organisation of village production and export.

781 – **Experiments with the Biorisator** (1). — WEIGMANN, in *Molkerei Zeitung*, Year 28, No. 46, pp. 885-886; No. 47, pp. 899-901. Hildesheim, June 17 and 19, 1914.

The experiments made by passing several hundred gallons of milk through a Biorisator capable of dealing with 55 galls. of milk per hour have confirmed in the main the conclusions arrived at in former tests. They show further that cheeses made with biorized milk are richer in water and softer than cheeses made at the same time with exactly the same quantity of raw milk. Biorized milk kept good 2 ½ days, while raw milk turned after one day.

Altogether the writer is of opinion that the process is useful, but he recommends that care be taken to prevent new infection of the biorized milk.

(1) See also No. 743, *B.* June 1913; No. 1190, *B.* Oct. 1913; No. 1389, *B.* Dec. 1913 No. 570, *B.* June 1914. (*Ed.*).

782 – **The Action of the Enzymes due to Organisms on the Rind of Hard Cheeses.** — GRATZ, O. and SZANYI, ST. in *Biochemische Zeitschrift*, Vol. 63, Parts 4, 5 and 6, pp. 436-478. Berlin, June 6, 1914.

Careful examination of the various layers of cheese, starting from the outside and proceeding inwards, leads to the conclusion that in Trappist and Ovar cheeses the enzymes of the flora of the rind have no action on the decomposition of casein and fat in the inside of the cheeses. Further, on theoretical grounds, the possibility of the diffusion of the enzymes from the rind towards the interior must be rejected.

783 – **The Preparation of Buffalo Skins for Export from the French Colonies.** — BOULANGER, H. in *Bulletin de l'Office coloniale du Ministère des Colonies*, Year VII, No. 75, pp. 131-144. Melun, March 1914.

It is pointed out that the buffalo skins arriving on the European markets from the French colonies are frequently in a very unsatisfactory condition owing to faulty methods of preparation, and compare unfavourably with similar products from the Dutch Indies, Burma, India and Egypt ; certain reforms are advocated.

AGRICULTURAL PRODUCTS: PRESERVING, PACKING, STORAGE, TRANSPORT, TRADE.

784 – **Agricultural Storehouses in Bavaria (Financial Year 1912-13).** — *Landwirtschaftliches Jahrbuch für Bayern*, Year 4, No. 4, pp. 365-415. Munich, 1914.

The number of agricultural storehouses in Bavaria, in the year 1912-13, was 177, against 169 in the preceding year. The total cost of building and arranging them was in round numbers £193 000. The cereals delivered to the stores amounted to 119 920 tons and those sold to 115 560 tons. In 1900-01 the corresponding figures were 29 728 and 28 522 tons.

Out of these 177 storehouses only 35 are for the exclusive service of the members of the associations that work the storehouse, while the remaining 142 can be used by non-members also. In 135 stores the cereals must be bought at fixed prices, and 23 advance money on cereals. The amount of the loan varies from 33⅓ to 95 per cent. of the sale price. Some stores, besides purchasing at fixed prices, act as brokers for the sale of cereals, while 23 do not trade at all in cereals. In 32 of these storehouses, storage dues are levied ; these range from 2½*d* to 10*s* per ton. For cleaning and grading the grain 83 stores have a scale of charges somewhat higher for non-members than for members. The dues vary from 1*s* to 12*s* per ton. Fifty stores grind cereals, at charges ranging from 2*s* to 20*s* per ton.

Of the 177 storehouses, 93 are managed by loan banks, 40 by storehouse cooperatives and by purchase and sale associations, 27 by larger federations of associations, 10 by agricultural district associations, 4 by private enterprize and one each by a peasants' association and by a fruit-growers' association.

Besides dealing with the sale of agricultural produce, these storehouses purchase agricultural machines and implements, concentrated foods, seeds, coals and the like.

Eighty-nine of these stores showed a profit at the end of the year and 54 a loss. In the preceding year the figures were respectively 130 and 6.

In 1913 the State granted subventions amounting to £200, and loans bearing 2 per cent interest amounting to £956.

PLANT DISEASES.

DISEASES NOT DUE TO PARASITES AND OF UNKNOWN ORIGIN.

785 – **Leaf-Spot Disease of Sisal in German East Africa.** — BRAUN, K. in *Der Pflanzer*, Year X, Part 4, pp. 188-197, plate III. Daressalam, April 1914.

In 1913 leaves of Sisal were found to be more severely attacked than usual by a leaf-spot disease ; the spots were sunken and parti-coloured or white ; at the time of utilizing the leaves, these spots formed dark masses with difficulty separated from the fibres.

Experiments on the cause of this disease have shown that it may be produced by high temperatures. A temperature of 41° C. for 10 minutes may have a decidedly injurious action, and such temperatures frequently occur in the hot steppes. It is not yet known whether the susceptibility is increased by other factors unfavourable to the plant.

786 – **Researches on Gummosis and the Effects of Frost on Cherry Trees.** — SORAUER, P. in *Landwirtschaftliche Jahrbücher*, Vol. XLVI, Part 2, pp. 253-273 + 2 plates. Berlin, April 6, 1914.

In continuation of previous experiments and researches the writer in 1910 barked a few ungrafted sweet cherry trees (*Prunus avium*) about 20 to 30 years old. On some of the trunks the bark was removed all round, on others only on one side for a length of about 3 feet; in all of them the sap-wood was reached. The object of this was to determine whether the irritation caused by the wound was alone the cause of gummosis as is currently believed.

The experiments have proved that the irritation theory, according to which only wounds cause gummosis, is not correct in this form. A wound can certainly produce gummosis, but many wounds are not accompanied by gummosis. On the other hand this disease appears also on spots that have not been in any way wounded.

In the above experiments no centres of gummosis appeared in the wound-callus in the bark. On the other hand such centres appeared in the tissues (and precisely in the recently formed wood) of those portions

of the trunk which were not injured and which were formed, at the same time as the callus tissues, under the old bark. These diseased spots in the wood of recent formation and still in a parenchymatous state grow larger as the distance from the wound increases, but only up to a certain limit, beyond which none are found. In the older annual rings formed before the callus, the disease does not appear at all. The irritation caused by the wound may be considered the sole cause of this.

The wound, according to the writer's observation, causes a considerable afflux of protoplasmic matter towards the tissues that it has laid bare and to the neighbouring parts, which thus acquire the character of young growth necessary for the formation of callus tissue. This flow of protoplasm leads, however, at the same time to an accumulation of the enzymes present in all young tissues; of these, the cytases appear first, while the coagulases increase only gradually.

If these enzymes find their natural employment, as is the case in every young normally growing part of a plant, in which there is a sufficient formation of new cells, no anomalies are caused, and consequently no gummosis spots are produced on the new bark that is formed. In the adjoining parts of the trunk, which have not been deprived of their bark and where the normal pressure of the latter hinders the increase of new cells, an unfavourable ratio is established between the afflux of enzymes and their utilization in the formation of new tissue. The consequent excess of cytases causes outbreaks of gummosis. Near the wound these outbreaks are smaller, because the formation of wood and of new cells increases and the enzymes are utilized to a greater extent. At a certain distance from the wound these effects cease, because the irritation due to the wound is no longer felt. A wound thus causes gummosis only when an unfavourable ratio is set up between the quantities of enzymes flowing towards it and their utilization, thus causing an excess of cytases. This excess of dissolving enzymes prevents the formation of normal cell walls in the cambium tissues, or redissolves those already formed in the older tissues; in this case the cytases proceeding from the inside of the cell towards the outside cause the dissolution of the secondary membrane, and the result is gummosis.

This unfavourable ratio between the hydrolizing and coagulating enzymes appears not only in cases of traumatic origin but often in uninjured tissues. Thus the writer was able to prove the presence of gummosis in the vegetative cone of completely sound twigs. The contours of wounds are the spots on which these ruptures of enzyme equlibrium more frequently occur. It is not the wound in itself that determines gummosis.

BACTERIAL AND FUNGOID DISEASES.

GENERALITIES 787 – **New Fungi.** — SYDOW, H. and P., in *Annales Mycologici*, Vol. XII, No. 2, pp. 195-204. Berlin, 1914.

This (twelfth) report gives descriptions of one genus and 32 species of fungi new to Science, collected at various times and in various countries.

They include the following: *Hemileia Holarrhenae* on leaves of *Holarrhena antidysenterica* in Eastern India; *Aecidium parile* on leaves of *Loranthus* sp., which is itself parasitic on *Goniothalamus Elmeri*, in the Philippines; *Entyloma Oryzae* on rice leaves in the Philippines; *Meliola Memecyli* on leaves of *Memecylon edule* in Eastern India; *Cercospora Artocarpi* on leaves of *Artocarpus indica* in the Philippines; *C. Canavaliae* on leaves of *Canavalia ensiformis* in the Philippines; *C. pachyderma* on leaves of *Dioscorea alata* in the Philippines; *C. Puerariae* on leaves of *Pueraria phaseoloides* in the Philippines.

788 – **Contribution to the Mycological Flora of the Tyrol and Istria.** — BUBÁK, FR. in *Annales Mycologici*, Vol. XII, No. 2, pp. 205-220, plate VIII. Berlin, 1914.

Among fungi collected in the Tyrol and Istria in 1912 and 1913, the following occurrences are noteworthy:

Melampsora Lini (D. C.) Tul., which produces rust of cultivated flax, on *Linum angustifolium* in Istria.

Rehmiellopsis conigena Bubák (new) on the apophyses of the cone-scales of *Pinus halepensis* and *P. Pinea* in the Tyrol.

Ceuthospora phacidioides (Grev.) var. *Oleae* Scalia in olive groves in the Tyrol.

Cycloconium oleaginum Cast., so far only known from olive (on which it produces the leaf-spot disease known in Italy as "olive pox" or "peacock's-eye"), has now been found in the Tyrol on *Phillyrea latifolia* (Oleaceae).

Cladosporium episclerotiale Bubák (new) on sclerotia of *Sclerotinia cinerea* Schröt. (producing brown-rot of stone fruits) from mummified plums, in the Tyrol.

789 – **Parasitic Fungi from Northern Japan** (1). — SYDOW, H. and P., in *Annales Mycologici*, Vol. XII, No. 2, pp. 158-165, 1 fig. Berlin, 1914.

This second contribution to the parasitic fungus-flora of Northern Japan includes 55 species, *viz.* Uredineae, 33; Ustilagineae, 1; Phycomycetes, 2; Ascomycetes, 7; Fungi Imperfecti, 12. Most of these were collected in 1913; one genus and eight species are new.

The following are of special interest:

Puccinia triticina Eriks. on *Triticum vulgare* L.

Uropyxis Fraxini (Kom.) P. Magn., on *Fraxinus longicuspis* Sieb. et Zucc., new for Japan.

Gymnosporangium Yamadae Miyabe: aecidia on leaves of *Pyrus Malus* L., teleutospores on branches of *Juniperus chinensis* L. (2).

Phytophthora infestans (Mont.) De Bary, on *Solanum Melongena* L.

Mycosphaerella Yamadai Syd. (considered by Salmon as a variety of *M. Alni*), on leaves of *Hovenia dulcis* Thunb.

Cystotheca lanestris (Harkn.) Sacc., on *Quercus glandulifera* Bl.

(1) See also No. 608, *B.* Feb. 1911: No. 994, *B.* March 1911; No. 1529, *B.* May 1911. (*Ed.*).

(2) See No. 481, *B.* May 1914 and No. 578, *B.* June 1914. (*Ed.*).

Discosia maculiformis Syd. (new), on living leaves of *Fagus sylvatica* L. var. *Sieboldi* Maxim.

Clasterosporium degenerans Syd. (new), on living leaves of *Prunus Mume* Sieb. et Zucc. (1).

790 – **Parasitic Fungi from Formosa.** — SYDOW, H. and P., in *Annales Mycologici*, Vol. XII, No. 2, pp. 105-112. Berlin, 1914.

The fungus flora of Formosa was previously quite unknown. The writers now record 50 parasitic fungi collected there between 1905 and 1914; they include: Uredineae, 44 (13 new); Phycomycetes, 1; Ascomycetes, 2; Deuteromycetes, 3 (2 new).

The following species occurring on cultivated plants may be mentioned:

Kuehneola Fici (Cast.) Butl., on leaves of fig (*Ficus Carica* L.), *Broussonetia papyrifera* (L.) Vent. and white mulberry (*Morus alba* L.).

Ochropsora Sorbi Diet., on leaves of *Pyrus sinensis* Lindl.

Phleospora Mori (Lév.) Sacc., on leaves of *Morus alba*.

RESISTANT PLANTS

791 – **Resistance of Potatoes to Blight (*Phytophthora infestans*) in New Zealand.** — HILL, W. S., in *The Journal of Agriculture*, Vol. VIII, No. 4, pp. 370-371, 1 fig. Wellington, N. Z., 1914.

At the experimental farm at Moumahaki it has been observed that the potato Gamekeeper is very resistant to the disease (*Phytophthora infestans*), while Up-to-date growing beside it suffers severely. The former seems to be well adapted to the light soil and damp climate of the locality.

MEANS OF PREVENTION AND CONTROL

792 – **Commercial Sulphate of Copper and the Determination of the Copper in it.** — MACH, F. and LEDERLE, P. in *Die landwirtschaftlichen Versuchs-Stationen*, Vol. LXXXIV, Part 1-2, pp. 129-143. Berlin, April 14, 1914.

The writers examined five samples of sulphate of copper (one from Switzerland, two from Germany, one from Belgium and one from England) at the Agricultural Experiment Station of Augustenberg, Baden; they observed a difference in the behaviour of the samples when crystals of equal weight were dissolved in distilled water at room temperature. The crystals of two samples took 90 minutes to dissolve, two others 120 minutes and one 85. When these crystals were ground, no difference in the time required for their solution was observed. In the preparation of Bordeaux mixtures with these solutions, after standing one hour some differences were noticed, which on standing longer almost completely disappeared. On adding to 100 gallons of these mixtures 1 lb. of sugar they all behaved completely alike, precipitating but little and showing also after standing a length of time the same slimy consistence. The writers come to the conclusion that as far as their practical use is concerned the samples examined all have the same value.

As large well coloured crystals cannot, without further examination, be considered pure (they may, for instance, contain sulphate of manganese) the writers consider a qualitative analysis to be indispensable.

For the determination of the copper content they adopted R. Win-

(1) See No. 581, *B.* March 1912. (*Ed.*).

disch's method with sodium hypophosphite, and the method proposed by Rhead and recommended by Moser with titanium trichloride. The first method almost always gave somewhat too low values ; it is suitable only where the saving of time is a consideration, while the titanium trichloride method gives very reliable values.

793 – **Comparative Spraying Experiments with Several Fungicides against Vine Mildew.** — BRETSCHNEIDER, A. in *Zeitschrift für das landwirtschaftliche Versuchswesen in Oesterreich*, Year XVII, Part 3-4, pp. 106-118. Vienna, March-April 1914.

In 1913 experiments on the control of vine mildew (*Plasmopara viticola*) were made in various parts of Austria, Bordeaux mixture being compared with the following commercial fungicides : " Antiperonospora " (2 per cent.), " Cupran " (1, 2 and 3 per cent.), " Cuprosulfid " (½, 1 and 2 per cent.), " Forhin " (1 and 2 per cent.), " Kupferchlorid " (1, 2 and 3 per cent., apparently identical with the " Pasta Caffaro " long used with success in Italy) ", " Perocid " (" Cerdidyum sulfat ", 1, 2 and 3 per cent,), and lime-sulphur wash (1 : 30 and 1 : 40).

These fungicides have also been tried in some places against mildew of Cucurbitaceae (*Pseudoperonospora cubensis*) and certain fungi affecting fruit trees (*Fusicladium, Monilia, Sphaerotheca*, etc.).

The adhesiveness of the various mixtures was generally good ; as for the visibility of the sprayed foliage, it was best with " Perocid " and Bordeaux mixture and sufficiently good with the other mixtures, with the exception of " Cupran ". For rapidity of preparation, all the fungicides, with the exception of copper sulphate and " Perocid ", dissolve rapidly. " Cupran " and " Kupferchlorid " dissolve without leaving any residue, " Forhin " leaves a little and " Antiperonospora " rather more. " Cuprosulfid " settles very rapidly. " Cupran ", " Knpferchlorid " and " Perocid " have a neutral reaction, " Cuprosulfid " and " Antiperonospora " have a slightly acid one, and " Forhin " is very acid. With the exception of " Cupran " and " Antiperonospora " none of the mixtures clog the sprayers. " Cuprosulfid " and " Antiperonospora " cause considerable scorching of the foliage, " Cupran " and " Forhin " (one case) also, but in a lesser degree. The other fungicides, including the two sulphur preparations, are harmless.

As regards the fungicidal power of the several preparations, the writer observes that the results of the experiments have only a relative value, because in 1913 only few localities were visited by a severe attack of mildew. In the scale of efficiency the first place is held by Bordeaux mixture ; next in order of merit are : " Forhin " (which proved very good), " Perocid " (sufficiently effective in 3 per cent. solution), "Kupferchlorid " (effective but must be applied in 3 per cent. solution) ; then " Antiperonospora " (which did not completely prevent the appearance of mildew) and last of all " Cupran " and " Cuprosulfid ", which failed completely. It was not possible to judge the effect of the lime-sulphur wash, because where it was tried mildew had scarcely shown itself.

Against *Pseudoperonospora cubensis* all the fungicides that were tested proved unavailing.

The effect of the above fungicides in the control of the fungi of fruit trees could not be ascertained ; further experiments are necessary. "Antiperonospora ", " Cuprosulfid " and " Cupran " are not be taken into consideration, as they cause scorching even on apple trees.

The fungicides which deserve being considered in practical work for the control of mildew are : " Forhin " (which must be placed on the market with a more constant composition), " Kupferchlorid " (which is now sold in the form of paste, like the " Pasta Caffaro, " because under the form of powder it has not been satisfactory), and " Perocid ". The latter especially seems to have a future before it, because it costs much less than Bordeaux mixture ; the other two fungicides cost about the same and approach more the price of Bordeaux mixture.

BACTERIAL AND FUNGOID DISEASES OF VARIOUS CROPS

794 - **The Control of Damping-off Disease in Plant Beds.** — JOHNSON, JAMES, in *Agricultural Experiment Station of the University of Wisconsin, Research Bulletin* 31. pp. 29-61, figs. 1-12. Madison, Wis., March 1914.

Damping-off of tobacco seedlings in Wisconsin is generally produced by either *Pythium De Baryanum* Hesse or some species of *Rhizoctonia*. These two fungi can live on a great variety of hosts, as well as on organic matter in the soil.

The special points in the control of damping-off requiring further study were : 1) the strength of formalin sufficient to give complete control ; 2) the relative value of other fungicides ; 3) the value and practicability of steam sterilization of soils in the field.

In studying these points, tobacco and cress (*Lepidium sativum*) were grown in boxes in untreated soil, in sterilized soil inoculated with the organisms and in uninoculated sterilized soil, the various treatments being applied to the re-inoculated soils.

It was found that 1-100 formalin did not kill the fungus, though it kept it in check for some time. Treating the soil with 1-50 formalin, at the rate of two quarts per square foot of soil, will kill the fungi which cause damping-off, and hence will prevent the outbreak of the disease even under the weather conditions most favourable for its appearance. Formalin treatment has the further advantages of exerting a slight stimulating action on plant growth and of killing some weed seeds ; but the formalin costs a good deal and takes some time to act, while the soil dries out slowly after treatment.

Sterilization of the soil by heat has proved the most satisfactory method of preventing damping-off from all standpoints, except that under certain conditions it may be more expensive than formalin treatment. Where a steam traction-engine can be obtained, the sterilization is best performed by introducing steam under pressure from the engine below a galvanized iron pan inverted over the seedbed ; the edges of the pan should be driven into the soil an inch or so, and the steam applied for half an hour or an hour. Sterilization by heat has the further advantage of killing all weed seeds and insect pests, and of giving greatly increased vigor and growth of the plants sown afterwards.

795 – **The 1914 Outbreak of Rust on Winter Grain in Bavaria.** — HILTNER, L. in *Wochenblatt des Landwirtschaftlichen Vereins in Bayern*, 1914, No. 25.

In many parts of Bavaria rust on wheat and rye was so abundant in the summer as to cause general alarm. The attacks are almost all due to *Puccinia glumarum*, *P. triticina* being only occasionally associated with it.

As the ears were particularly badly attacked, total losses of crop were feared by the farmers ; but the writer points out that the experience of 1904 and 1911 shows that even a bad attack of yellow rust in the ears may result in nothing worse than some diminution of yield.

In previous outbreaks the following points were observed. In wheat, the local varieties are particularly subject to severe attacks of yellow rust (*P. glumarum*), whilst most other varieties, in particular the pedigree ones, remain nearly free. Many of the latter were, however, attacked by black rust (*P. triticina*), from about the middle of June, but without much damage being done. Yellow rust, which is often called spring rust, may appear as early as the end of April, as it did this year. In rye no marked distinctions between varieties as to rust-resistance have been observed.

There is a general consensus of opinion that rust is much favoured by one-sided nitrogenous manuring, especially with nitrate of soda ; this observation was, however, made before much care was taken to distinguish the different kinds of rust. In 1904 and this year (1914) it was found that yellow rust was less severe on fields properly manured, even when the dressing included sulphate of ammonia or nitrate, than on unmanured land ; also that thin crops were far more severely attacked than an even crop covering the ground properly. Unbalanced nitrogenous manuring is, however, favourable to yellow rust also, while dressings of phosphates have a marked effect in preventing rust ; cereals following a green manure crop are also very little subject to rust.

The true cause of severe outbreaks of rust is certainly the state of the weather. This year, just as in 1904, the outbreak was induced by the fact that in April a number of hot days were followed by frosts or heavy dews : then a spell of cool weather checked the growth of the crops, so making them very susceptible. The local varieties, which grow very quickly in spring, were the most severely attacked. Mists seem also very favourable to the spread of rust. The first reports of rust came from the same place each year, no doubt showing that the conditions there were suitable for an early outbreak, and confirming the importance of atmospheric conditions.

The writer suggests the advisability of making a comparative enquiry throughout Europe on the appearance of rust in its connection with varieties, soil, weather, etc., with a view to finding out the conditions leading to epidemics of this disease.

796 – **A Fungus Disease of Peppers (*Capsicum* spp.) : *Colletotrichum nigrum*.** — BANCROFT, C. K. in *The Journal of the Board of Agriculture in British Guiana*, Vol. VII, No. 3, pp. 139-140. Demerara, 1914.

In 1913 the fruits of various peppers (*Capsicum*) in the experiemental area of the Botanic Garden at Georgetown were attacked by a disease which spread so fast that some plants lost all their crop. The disease appears first in the form of spots at the apex or on the sides of the fruit ; these generally form when the fruit is half-grown. Concentric circles then form round the point of infection, and eventually the whole fruit may become involved, or may fall off. On the affected parts the fruit bodies of a fungus have been found : this has been identified as *Colletotrichum nigrum* Ellis et Halsted.

The fungus appears also to make its way down the stems for some distance.

Some varieties of pepper, such as Long White and Long Red, seem to be very subject to the disease, while others are less attacked ; Red Chilly and Long Bird seem to be quite immune.

The treatment adopted was to cut back the infected plants and spray with Bordeaux mixture : after the last spraying few fruits were attacked.

INSECT PESTS.

GENERALITIES

797 – **The Scale Insects of British Guiana.** — BODKIN, G. E., in *The Journal of the Board of Agriculture of British Guiana*, Vol. VII, No. 3, pp. 106-124. Demerara, 1914.

In British Guiana scale insects are the worst enemies of cultivated plants ; in general they are known as " blight ".

The following species, being widely distributed and attacking a great number of cultivated plants, are to be considered as highly injurious : *Aspidiotus destructor*, *Lepidosaphes beckii*, *Ischnaspis longirostris*, *Pseudococcus citri* and *Saissetia nigra*.

A number of species attack ornamental plants (in particular orchids and ferns) in sheltered places ; others, again, are constantly associated with certain crops, as *Aulacaspis rosæ* on mango and *Ripersia* sp. on sugarcane.

Many species are undoubtedly indigenous, while others have been introduced, especially from the West Indies, with fruits and provisions. A notable absence is that of *Diaspis* (*Aulacaspis*) *pentagona*, which is common throughout the West Indies. Certain well-known species, such as *Aspidiotus destructor* and *Vinsonia stellifera*, occur on trees and orchids in the virgin forests of the interior, while the most isolated native plantations are always found to harbour scales.

A number of natural enemies are known in the Colony. Besides some undetermined Hymenoptera, they include : *Blastobasis lecaniella* Busck, *Vitula bodkini* Dyar and *V. toboga* Dyar, Lepidoptera whose larvae feed on *Saissetia nigra*, *S. oleae*, *S. hemisphaerica* and *Ceroplastes floridensis* ; *Cryptognatha nodiceps* Mshl., *Azia trinitatis* Mshl. and *A. pontibrianti* Muls. (Coccinellidae), of which the first two attack *Aspidiotus destructor*

and the third *Saissetia hemisphaerica*; certain Neuroptera; and lastly two fungi — *Sphaerostilbe coccophila* (red-headed fungus) attacking chiefly *Chionaspis citri*, and *Cephalosporium Lecanii* (shield-scale fungus) attacking *Saissetia nigra*, *S. oleae*, *S. hemisphaerica*, *Coccus mangiferae* and *C. hesperidum*.

The following fifty-one species have so far been recorded from British Guiana:

Chionaspis citri Comstock (orange snow-scale), common on the trunks and branches of *Citrus* trees and on castor-oil.

Howardia biclavis Comstock, common on branches of jasmine (*Tabernaemontana Wallichiana*).

H. biclavis var. *detecta* Maskell, rare on branches of *Sapium Jenmanni*, a native rubber plant.

Diaspis boisduvalii Sign., frequent on shoots of plantains and on the orchid *Cattleya superba*.

D. echinocacti opuntiae Ckll., recorded in 1893 and 1899 on *Opuntia elongata*, but not observed since.

Aulacaspis rosae Bouché (mango snow-scale), common on leaves of mango and cinnamon.

Hemichionaspis minor Mask., not uncommon on cotton.

Pinnaspis buxi Bouché, common on leaves of ornamental palms and other plants.

Aspidiotus cydoniae Comstock, occasional on the stems of eggplants.

A. destructor Sign., abundant and injurious to coconut, banana, almond tree (*Terminalia Catappa*), avocado, etc.

A. diffinis Newstead, described from Demerara in 1893, but not found since in the Colony.

A. sacchari Ckll., sometimes common on sugarcane.

Morganella longispina Morgan, described from Demerara in 1889, on *Cupania sapida*, but not found since.

Selenaspidus articulatus Morgan (West Indian red scale), common on *Citrus* and leaves of Liberian coffee.

Chrysomphalus aonidum L. (red-spotted scale), frequent on leaves of *Citrus*.

C. aurantii Mask., rare on *Citrus*.

C. biformis Ckll., common on leaves of many orchids and on young sisal plants.

C. dictyospermi Morgan, described from Demerara in 1889, but not reported since.

C. dictyospermi var. *pinnulifera* Mask., recorded on crotons (*Cordiaeum*) at Demerara in 1893, but not found since.

C. dictyospermi var. *arecae* Newst., described from Demerara in 1893, but not found since.

C. personatus Comstock, common on leaves of star-apple (*Chrysophyllum Cainito*), ornamental palms and mangoes; occasional on leaves of Para rubber (*Hevea brasilensis*).

Lepidosaphes beckii Newm. (orange mussel-scale), one of the commonest

in British Guiana, occurring on *Citrus*, *Codiaeum*, Barbados cherry (*Malpighia glabra*), etc.

L. pinnaeformis Bouché, recorded from Demerara in 1892, but not reported since.

Ischnaspis longirostris Sign., frequent on leaves of Liberian coffee, to which it is very injurious, and on ornamental palms.

Parlatoria zizyphus Lucas, occasional on leaves of *Citrus*.

Orthezia insignis Douglas, common and very injurious on various Composites and *Citrus*.

O. praelonga Douglas (croton bug), fairly common on crotons (*Codiaeum* spp.), mango, Barbados cherry, sugarcane, *Sapium Jenmanni*, etc.

Asterolecanium bambusae Bdv., common on bamboos.

A. fimbriatum Fonsc., recorded from Demerara in 1889, but not found since.

A. pustulans Ckll., common on leaves of orchids and akee (*Blighia sapida*); occasionally damages Para rubber.

Lecaniodiaspis dendrobii Douglas, described from Demerara in 1892 on *Dendrobium* and *Codiaeum*, but not reported since.

Ceroputo barberi Ckll., reported on *Schinus terebinthifolius*.

Pseudococcus citri Risso (common mealy bug), very common on *Citrus*, cacao, ferns, *Codiaeum* and rice ; rare on sugarcane.

P. nipae Mask., occasional on coconut and other palms.

P. virgatus Ckll., occasional on egg-plant.

Ripersia sp. (sugarcane mealy bug), common on leaves of sugarcane.

Tachardia lacca Kerr. (the Indian scale producing lake), recorded in 1800 on *Erythroxylum Coca* in the Botanic Garden at Georgetown, but apparently now extinct.

Pulvinaria sp., rare on leaves of sugarcane.

P. pyriformis Ckll. (mealy shield-scale), common on guava, avocado and ornamental plants.

P. simulans Ckll., recorded on *Licuala grandis*.

Ceroplastes denudatus Ckll., recorded in 1893 on *Codiaeum*, but not found since.

C. dugesii Towns, recorded on *Schinus terebinthifolius*.

C. floridensis Comst. (Florida wax-scale), common on limes and various ferns.

Vinsonia stellifera Westw. (glassy star-scale), very common on leaves of coconut and other ornamental plants, on French cashew (*Eugenia Jambolana*), *Citrus*, and various forest trees of the interior.

Eucalymnatus perforatus Newst. (tesselated shield-scale), occasional on leaves of coconut and French cashew.

Coccus hesperidum L. (common shield-scale), common on *Citrus* and Liberian coffee.

C. mangiferae Green (mango shield-scale), common on leaves of jasmine (*Eugenia paniculata*) and mango.

Saissetia begoniae Douglas, described in 1802 on begonias, but not found since.

S. hemisphaerica Targ. (brown shield-scale), common on Liberian coffee, *Citrus*, guava, various ferns, etc.

S. nigra, Nietn. (hibiscus shield-scale), very common on *Sapium Jenmanni*, Para rubber, ochroe (*Hibiscus esculentus*), *Codiaeum* sp., egg-plant, cotton, sunflower and various ornamental plants.

S. oleae Bern., common on *Citrus*, *Duranta* and various ornamentalplants.

798 – **Injurious Scales from the Seychelles.** — GREEN, E. ERNEST, in *The Journal of Economic Biology*, Vol. 9, No 1, pp. 47-48. London, 1914.

In a small collection of injurious insects from the Seychelles, the following scales have been determined.

Aspidiotus ficus Ashm., on leaves of *Zamia* sp. (Cycadaceae), much grown for ornament in tropical countries.

A. bromeliae Newst., on leaves of pineapple. The discovery of this species is interesting, as it was previously only known from examples found on pineapples on sale in England, probably from the Canaries. The amount of infection appears to show that it may do a good deal of damage.

Lecanium hesperidum L. and *L. tessellatum* Sign., on leaves of water hyacinth (*Eichhornia crassipes* = *E. speciosa*). As this plant is very harmful in blocking canals and rivers (1), the scales must be considered useful in this case.

L. hemisphaericum Targ., on leaves of *Justicia Gendarussa*. Many species of the genus *Justicia* are shrubs with very ornamental flowers; they seem to be particularly subject to the attacks of scales, in Ceylon chiefly *Orthezia insignis*. *L. hemisphaericum* is a cosmopolitan species, attacking almost all plants except Coniferae and Gramineae.

799 – **Experimental Demonstration of a Difference in Biological Race between the Phylloxera of the South of France and that of Lorraine: *Perityмbia (Phylloxera) vitifolii pervastatrix.*** — BÖRNER, CARL, in *Zeitschrift für angewandte Entomologie*, Vol. I, Part I, pp. 59-67. Berlin, 1914.

As the writer had previously observed differences between the behaviour of the phylloxera of Villers l'Orme (Lorraine) and that of the South of France towards certain varieties and species of vines, he proposed to determine by means of experiments with both kinds of phylloxera whether the differences observed were due to a difference of race or to the different climate or nutrition of the insect. With this object in view, American vines and their hybrids with European vines were infected with phylloxera from Lorraine at Villers l'Orme, while in a French vineyard at Pagny-sur-Moselle (near the frontier) gall-producing phylloxera brought expressly from the south of France were used. The vines came from the same mother plants, were of the same age and had all been grown in Lorraine. Any difference in the susceptibility to attacks in vines of the same variety could thus be due only to some biological difference in the phylloxera used to infect them.

The experiments showed that biological differences really exist and

(1) See No. 333, *B.* April 1913. (*Ed.*)

reveal themselves in the repulsion shown by the phylloxera of Lorraine to certain vines which are attacked by the French phylloxera. The writer therefore considers the Lorraine phylloxera as a distinct race (the *Pervastatrix* race).

Among the results of the experiments the following are to be mentioned. At Villers l'Orme the following varieties inoculated with Lorraine phylloxera proved completely immune and showed no galls on the leaves or nodules on the roots : Riparia Gloire de Montpellier, Riparia × Rupestris 107 Geisenheim, Riparia × Rupestris 3306 and 3309 Couderc, Riparia × Chasselas 24 Laquenesey, Cordifolia × Rupestris 19 Geisenheim. Isolated small fertile galls together with sterile galls and punctures and occasionally small nodosities were found on Aramon × Rupestris Ganzin No. 1. A regular formation of larger or small nodosities, together with the absence of leaf galls, was shown by Riparia × Rupestris 175 Geisenheim, Riparia × Rupestris 101-14 Richter, and Riparia × Cunningham 535 Oberlin.

These varieties all showed normal formation of galls and root nodosities when inoculated with phylloxera from the South of France, with the exception of Aramon × Rupestris Gauzin No. 1, which behaved in the same way to both races (1).

Whether the *Pervastatrix* race has arisen through adaptation to European vines or already existed in America on the Labrusca vines so closely allied to European vines, has not yet been decided. Apparently climate has not had any noticeable influence on its development.

Notwithstanding the very numerous infection experiments made under varying conditions, it has never been possible to get the *Pervastatrix* race to adapt itself to one of the completely immune vines ; it may therefore be assumed that it is impossible for the *Pervastatrix* race to readapt itself from its usual host plants (European and Labrusca vines) to plants immune from its punctures, because on the latter it dies.

In the cross between immune and susceptible vines, immunity apparently behaves as a dominant character.

Inoculations of immune vines with root phylloxera coming from Alsace, Württemberg and Saxony have never led to infection, so it may be concluded that the *Pervastatrix* race has a wide distribution in Germany.

The writer divides the vines so far examined as to their behaviour towards the *Pervastatrix* race into the four following groups :

1. *Immune vines*, embracing many pure races of *Vitis riparia* (*vulpina*), as well as *V. rubra* and the races of *V. Berlandieri* ; then a number of hybrids, for instance Riparia × Rupestris Couderc 3306 and 3309, Geisenheim 107, Cabernet × Rupestris 33 a 1, Cordifolia × Rupestris Geisenheim 19 and 20, Hybrid Franc, Hybrid Dromois.

(1) Recently vines which had proved immune to the *pervastatrix* phylloxera after repeated inoculations (1912 and 1913), were inoculated with phylloxera from the South of France and immediately showed the formation of root nodosities.

(*Authors' note*).

2. *Vines subject to attack.*

a) Vines slightly attacked, generally quite free after the winter (resistant vines). To this group belong the following: Aramon × Rupestris Ganzin No. 1, Mourvèdre × Rupestris 1202, Aramon × Riparia Teleky 143 B, Riparia × Gamay Oberlin 595 and 604.

b) Vines which permanently show leaf galls (mostly sterile) and root nodosities, but which for the most part are resistant: Riparia × Rupestris 101-14, Riparia × Vinifera 44 Laquenesey, Madeleine royal × Riparia 33 Laquenesey.

c) Normally attacked vines (fertile galls and root nodosities), susceptible to permanent infection, and easily attacked: *Vitis vinifera* and *V. silvestris* (European vines); then *V. Labrusca* with its hybrids, and the American vines; *V. arizonica, V. Berlandieri, V. cordifolia, V. monticola, V. palmata, V. rupestris* and *V. Solonis*. This group also includes several Asiatic vines and numerous hybrids: Berlandieri × Riparia, Rupestris × Vinifera, Riparia × Labrusca, etc.

According to the writer it would be strongly advisable to impose the greatest limitation on the introduction of foreign vines into Germany, on account of the danger of introducing the phylloxera from the South of Europe.

MEANS OF PREVENTION AND CONTROL

800 – **Hymenoptera Parasitic on *Aphis euonymi*, the Beet Aphis** (1). — MALAQUIN, A., and MOITIÉ, A., in *Comptes rendus hebdomadaires des Séances de la Société de Biologie*, Vol. LXXVI, No. 16, pp. 803-805. Paris, 1914.

So far seventeen secies of Hymenoptera have been found to parasiti ze *Aphis euonymi*. They are as follows:

Aphidiidae: gen. *Praon* (one sp. near *P. abjectus* Halid.); gen. *Trioxys* (*T. auctus* Hald., *T. heraclei* Hald.); gen. *Aphidius* (*A. crepidis* Hald., *A. urticae* Hald. and two others).

Proctotrupidae: gen. *Lygocerus* (*L. antennalis* Kief., *L. rufipes* Thoms.); gen. *Sceliolina* (two undetermined species).

Cynipidae: gen. *Allotria* (*A. minuta* Hart. and two other spp. undetermined); gen. *Alloxysta* (*A. crassa* Cam.).

Chalcididae: gen. *Encyrtus* (one sp. undetermined); gen. *Pteromalus* (one sp. undetermined).

The two commonest species are *Trioxys auctus* and *Aphidius crepidis*. They attack chiefly apterous individuals of the aphis, laying one egg in each; the act of oviposition takes two or three seconds. The parasitized aphis shows no unusual symptoms for three or four days, and if not adult continues to grow and complete its metamorphosis; after this it becomes sluggish, turns from black to pale olive-green and finally to brown, swells up and dies. The dead body is almost spherical and adheres to the leaf by means of a sticky liquid, thus presenting a very characteristic appearance.

T. auctus takes three weeks to develop, while the aphis requires fifteen to eighteen days, according to the weather; other parasites (*Aphidius, Encyrtus*) take about as long as *Trioxys*.

(1) See also No. 296, *B.* March 1914.

In autumn, the latest Hymenoptera deposit their eggs in the sexual female aphids, then living on spindle (*Euonymus europaeus*). The females pass the winter on the twigs, and the Hymenoptera emerge from the parasitized ones towards the end of March or in early April ; the healthy *Aphis euonymi* appear early in March.

The pupa of *Trioxys* within the aphis is protected by a white silky covering, whereas that of *Allotria* is covered only by the empty skin of its host.

As showing the importance of these parasites, the writers refer to the two following cases of infection :

a) On the 9th and 19th of June, 1913, twenty individuals of *Trioxys auctus* of both sexes were liberated in a breeding-cage containing two beets whose leaves were infested by about a thousand aphids ; on the 2nd of July more than 500 showed the characteristic appearance of being parasitized.

b) In a small garden, plants of *Euonymus*, beets, *Lysimachia vulgaris*, *Epilobium angustifolium*, thistles, etc., were covered with aphids ; at the beginning of July some thousand individuals of *Trioxys auctus* and *Aphidius crepidis* were liberated : by the 15th of August it was almost impossible to find a living and healthy aphis ; some stems of beets for seed showed over 300 parasitized aphids.

801 – **New Species of *Aphelinus* Parasitic on Injurious Aphids in Russia** (1). — KURDJUMOV, N. B., in *Revue Russe d'Entomologie*, 1913, Vol. XIII, No. 2, pp. 266-270. St. Petersburg, 1913.

Four new species of *Aphelinus* (*Chalcididae*) have been bred from injurious aphids at the Poltava Experiment Station. They are as follows : *A. toxopteraphidis* and *A. flavipes* from *Toxoptera graminum* Rond. ; *A. hordei* from *Brachycolus noxius* Mordw. ; and *A. atriplicis* from *Aphis chenopodii* Schrank. (*A. atriplicis* L.).

802 – **Two New Genera of Hymenoptera Parasitic on *Ectoedemia*.** — ROHWER S. A., in *Psyche*, Vol, XXI, No. 2, pp. 79-81, figs. 1-2. Boston, Mass., 1914.

The writer describes two new genera of Hymenoptera, *Anomopterus* and *Centistidea*, each represented by a single species ; these genera belong to the sub-family *Liophroninae*, and come near *Centistes*.

Anomopterus fasciipennis is parasitic on *Ectœdemia phloeophaga* Busck, and *Centistidea ectoedemiae* on *E. castaneae* Busck, both of which are injurious to sweet chestnuts in Virginia.

INSECTS INJURIOUS TO VARIOUS CROPS

803 – ***Remigia repanda*** **(Lepidoptera), injurious to Crops in Sao Paulo, Brazil.** — HEMPEL, ADOLPHO, and D'UTRIA, GUSTAVO, in *O Fazendeiro*, Year VII, No. 3, pp. 110-111. São Paulo, 1914.

Remigia repanda is widely spread in the State of São Paulo ; its larvae are very voracious and feed chiefly on Gramineae, in particular maize, rice and sugarcane. The moth has a number of broods in the year.

(1) See also No. 294, *B.* March 1914. (*Ed.*).

To prevent attacks, one measure is to burn off the vegetation of waste places, in which the eggs are laid.

If a crop is attacked, aceto-arsenite of copper may be used as a spray (2 lbs. per 100 gallons of water, with the addition of 2 lbs. of soap and 4 lbs. of sugar, or 1 gallon of molasses, to make it stick). For grass crops 1 lb. per 100 galls. is enough. In some cases it may be worth while to burn off a crop and plough it under, so as to destroy the larvae and pupae and prevent subsequent attacks.

To stop the larvae spreading, trenches may be dug round the centres of infection. A belt of quicklime on the ground will also stop them.

Many birds are useful in destroying these larvae.

804 – **The Lesser Bud-Moth *(Recurvaria nanella)* on Apples in Michigan.** — Scott, E. W., and Paine, J. H., in *Journal of Agricultural Research*, Vol. II. No. 2, pp. 161-162. Washington, D. C., 1914.

In the spring of 1912, during spraying experiments on apples at Benton Harbour, Scott noticed serious damage caused by small larvae to the buds of unsprayed trees ; in one neglected plantation in the neighbourhood, the insect was largely responsible for a complete loss of crop. The damage was attributed at the time to the eye-spotted bud moth (*Tmetocera ocellana* Schiff.).

In 1913 the life-history was followed out ; various differences were found between the insect from Benton Harbour and *T. ocellana*. On examining the adults, A. C. Busck referred them to *Recurvaria crataegella*, described by him in 1903 ; further research by Busck and the writers has shown that this is identical with the European *R. nanella* Hübn. (known as the lesser bud-moth), so that *R. crataegella* is to be considered a synonym of this.

European authorities had recorded this species on apple, pear, apricot, peach, cherry and plum. According to Staudinger and Rebel (1901), the distribution in Europe is : C. Europe, Sweden, N. Spain, S. France, C. and N. Italy, Dalmatia and S. W. Russia.

805 – ***Coccus citricola*, a New Scale infesting Citrus Trees in California.** — Campbell, Roy E. in *Entomological News*, No. 5, pp. 222-224. Philadelphia, 1914.

In 1909 a scale was found on citrus trees at Claremont which appeared to differ from the common *Coccus hesperidum* L. ; it was first referred to *C. longulus* Dong. and then to *C. elongatus* Sign., but the writer has recently determined it to be a new species, which he names *C. citricola*.

It is so far known only from leaves and branches of *Citrus*. The young scales mostly settle down on the leaves, but when half grown they migrate to the twigs. None have been found on branches more than half an inch in diameter, and they are confined to the lower branches. When the scales are abundant, as often happens, they fit over one another in a characteristic way, like tiles.

The insect has recently become much more abundant, and has been found in many fresh localities in Southern California, in the Lower San Joaquin valley and to a slight extent in the Sacramento valley. It has probably existed for some time in California, and may very likely have been confused with *C. hesperidum*.

The writer gives the systematic and biological characters distinguishing *C. citricola* from *C. hesperidum* and *C. elongatus*.

ALFREDO RUGGERI, gerente responsabile.

THE INTERNATIONAL MOVEMENT OF FERTILIZERS.

No. 1. *September 1, 1914.*

SUMMARY. — Introduction (p. 1101). — World's production of fertilizers (p. 1103). — International trade in fertilizers (p. 1109). — Consumption of fertilizers in different countries (p. 1124). — Prices of mineral phosphates, potash salts and nitrogenous fertilizers (p. 1132). — Bibliography (p. 1138).

INTRODUCTION.

This review is the first number of a half-yearly periodical whose publication was decided upon at the last General Assembly held at the Institute (Inst. int. d'agr., 4ème Ass. gén., Décis. II, Rapport Pioda-Laur, 1913). The general plan of the review was established by the Permanent Committee; it will appear regularly in the official (French) edition on March 1st and September 1st, that is to say at those times of year when purchases are being made by consumers, and will form a continuation to *Production et consommation des engrais chimiques dans le monde,* already published by this Institute.

As regards the products to be considered, the scheme laid down in the above publication has been adhered to and the fertilizers limited to the following categories :

1. *Phosphatic fertilizers :* mineral phosphates, basic slag, superphosphates, guanos, bones.

2. *Potassic fertilizers :* Stassfurt salts, other potassic fertilizers.

3. *Nitrogenous fertilizers :* nitrate of soda, sulphate of ammonia, synthetic fertilizers, organic fertilizers.

In consideration of the similarity of their market conditions, sulphur and copper sulphate have been included in the Review as other products useful to agriculture.

The Review comprises five parts: production, imports and exports, consumption, prices, bibliography.

The figures given refer as far as possible to the whole year 1913 and to the first half-year of 1914; those referring to 1912 have also been reproduced for comparison. Prices are those of the first half of 1914 and of forward deliveries for the end of 1914 (1). The next number of the review, to appear on March 1, 1915, will contain final figures for 1913, and as far as possible all those for 1914, while prices will refer to the second half of 1914 and of forward deliveries for the beginning of 1915.

Production. — Each fertilizer forming a different category is tabulated according to its production in the different countries.

Imports and exports. — The principal products which are classified under separate headings in official returns are each tabulated to show the commercial movement in the different countries; an official statement of the international situation is thus obtained.

Consumption. — A few figures obtained by the Institute will be published under this heading; statistical information on this point is very difficult to obtain and should form the object of future development.

Prices. — Wholesale market prices from certain important markets are selected for reproduction and where necessary a distinction will be drawn between nominal quotations and actual selling price. This part of the Review will be further developed as time goes on in order that it should prove of the greatest possible practical value.

Prices of mineral phosphates are given both in America and c. i. f. in Europe. Potash salts are quoted at the German official prices and at New York, the latter as representative of the most important independent market.

Official quotations from the principal markets are compared for nitrate of soda, sulphate of ammonia and synthetic manures during the first six months of 1914, the figures referring to prices at the end of each month.

Bibliography. — Discoveries of new beds or the adoption of new manufacturing processes for dealing with chemical products used in agriculture will be notified in this part of the Review, as well as new methods of applying such products or legislative measures in connection with them.

(1) Quotations for forward deliveries have become invalid owing to the present international situation.

WORLD'S PRODUCTION OF FERTILIZERS AND OF CHEMICAL SUBSTANCES FOR AGRICULTURAL USE.

Phosphatic Fertilizers.

I. — World's Production of Natural Phosphates.

Country	1912	1913	1st half-year 1914
	metric tons (1)	metric tons	metric tons
a) *Phosphorites:*			
United States of America	3 231 636	3 202 636	.....
Tunis	2 057 498	2 284 678	.....
Algeria	377 601	438 601	239 690
France	330 000	335 000	.....
Christmas Island	159 512	152 405	.....
Ocean and Nauru Islands	300 000	.....	.....
Belgium	203 100	.....	.....
Egypt	69 958	64 138	.....
Angaur (Palau Islands)	60 000	90 000	60 000
Makatea (Tuamotu Islands)	40 000	.....	.....
Dutch West Indies	20 362	.....	.....
Russia	25 000	25 000	.....
South Australia	6 198	.....	.....
French Guiana	.....	.....	.....
Spain	.....	.....	.....
Japan	7 879	8 000	.....
b) *Apatites:*			
Sweden	.....	.....	.....
Norway	.....	.....	.....
Canada	164	.....	.....
Total.....	6 888 908	(6 600 458)	.....

The figures for the United States refer to amounts mined; amounts sold were 3 146 573 m. tons in 1912 and 3 020 905 m. tons in 1913. The figures for Tunis also refer to amounts mined, while amounts despatched were 1 923 007 m. tons in 1912 and 1 984 880 m. tons in 1913. The figures for Algeria on the other hand refer to exports and should be increased by the amount consumed internally for the manufacture of superphosphate, which is in part exported (see Part 2, table III, p. 1111).

(1) Metric ton = 0.9931 long ton.

II. — World's Production of Basis Slag.

Country	1912	1913	1st half-year 1914
	metric tons	metric tons	metric tons
Germany	2 110 000	(2 200 000)	.....
France	679 000	(700 000)	.....
Belgium	534 000	(500 000)	.....
United Kingdom	400 000	404 000	.....
Luxemburg	253 000	(250 000)	.....
Austria-Hungary	92 000	(100 000)	.....
Italy	20 000	20 000	.....
Russia	16 000	32 000	.....
Sweden	15 000	(15 000)	.....
Other countries	(25 000)	(25 000)	.....
Total...	4 144 000	(4 246 000)	.....

Potassic Fertilizers.

With regard to the Stassfurt potash salts, figures are given which have been supplied by the German Potash Syndicate and it should be noted that these differ slightly from those published later by the German Imperial Office of Statistics (see *Vierteljahrshefte zur Statistik des Deutschen Reichs*).

III. — Production of Potash Salts in Germany.

Nature of salts	1912	1913	1st half-year 1914
	metric tons	metric tons	metric tons
a) *Crude salts* :			
Carnallite and kieserite	5 281 642.7	5 302 350.5	.....
Kainite (including hartsalz and shœnite) and sylvinite	5 788 371.6	6 305 160.0	.....
Total.....	11 070 014.3	11 607 510.5	.....
b) *Treated salts* :			
Choride of potash 80 %	471 434.6	484 254.1	.....
Sulphate of potash 90 %	115 728.4	110 783.6	.....
Sulphate of potash-magnesia calcined 48 %	55 987.2	58 269.1	.....
Potash manure salts 20, 30, 40 %	723 257.4	906 212.4	.....
Potash manure salts 38 %	48 059.0	50 393.4	.....
Sulphate of potash-magnesia, crystallised 40 %	172.5	119.4	.....
Kieserite in lumps	45 492.4	36 708.2	.....
Kieserite, calcined and ground	1 070.3	1 165.8	.....
Total.....	1 461 201.8	1 647 906.0	.....

IV. — Total Amounts of Potash Salts sold for Agricultural and Industrial Purposes (*as* K_2O).

Destination	1912	1913	1st half-year 1914
	metric tons	metric tons	metric tons
a) *For agricultural purposes* :			
Germany	463 383.6	536 102.6	.....
Other countries	440 375.4	467 810.6	.....
Total.....	903 759.0	1 003 913.2	.....
b) *For industrial purposes* :			
Germany	65 181.4	68 180.2	.....
Other countries	40 278.3	38 276.0	.....
Total.....	105 459.7	106 456.2	.....
Grand total.....	1 009 218.7	1 110 369.4	.....

Nitrogenous Fertilizers.

V. — General Movement of Chilean Nitrate.

Movement	1912	1913	1st half-year (up to May 31) 1914
	metric tons	metric tons	metric tons
Production	2 773 459	2 586 975	1 214 747
Export	2 739 530	2 494 166	1 016 629
Consignments for consumption	2 556 973	2 530 645	1 765 319
Visible stocks (Dec. 31)	1 765 867	1 620 056	1 205 420 (May 31)

VI. — World's Production of Sulphate of Ammonia.

Country	1912	1913	1st half-year 1914
	metric tons	metric tons	metric tons
Germany	492 000	549 000	.....
United Kingdon	394 500	425 700	.....
United States	149 700	176 900	.....
France	69 000	75 000	.....
Belgium	43 700	48 600	.....
Austria-Hungary	35 500	39 000	.....
Italy	11 100	15 000	2 200
Spain	12 000	15 000	.....
Netherlands	6 000	6 000	.....
Russia	4 000	8 000	.....
Japan	7 300	8 000	.....
Australia	3 000	3 000	.....
Denmark	2 400	2 800	.....
Sweden	1 400	1 400	.....
Other countries	(75 000)	(75 000)	.....
Total	(1 306 600)	(1 448 400)	.....

The figures for the United Kingdom refer to the total amount of ammonia produced stated as sulphate ; according to the Board of Trade the sulphate of ammonia actually produced would only be a little over 84.34 per cent. of these figures. The amount of ammonia produced in Italy in the first half-year of 1914 refers only to sulphate formed by the conversion of calcium cyanamide.

VII. — World's Production of Calcium Cyanamide.

Country	1912	1913	1st half-year 1914
	metric tons	metric tons	metric tons
Germany	(25 000)	(25 000)	.....
Austria-Hungary	5 000	(7 500)	.....
United States and Canada	(14 000)	(14 000)	.....
France	(7 500)	(7 500)	.....
Italy	10 304	14 982	12 000
Japan	5 199	(7 500	.....
Norway	13 892	22 111	.....
Sweden	6 043	(8 000	.....
Switzerland	(7 500)	(7 500)	.....
Total	(94 438)	(114 093	.....

Figures in brackets represent the productive capacity of the factories: others represent the actual production.

VIII. — Movement of Norwegian Nitrate of Lime.

	1912	1913	1st half-year 1914
	metric tons	metric tons	metric tons
Estimated production	.....	70 000	35 000
Exports	51 701	70 171	.....

Other Chemical Products for Agricultural Use.

IX. — World's Production of Crude Sulphur.

Country	1912	1913	1st half-year 1914
	metric tons	metric tons	metric tons
Sicily	356 531	345 349	159 243
	10 000	10 000	.....
Other Italian regions	37 497	37 839	.....
Italy (total)	404 028	393 188	.....
United States	308 328	316 575	.....
Japan	54 256	49 131	.....
Other countries	(50 000)	(50 000)	.....
Total...	816 612	808 894	.....

According to information from the " Consorzio solferino siciliano " the production in Sicily is made up of the amounts conveyed to exporting ports together with the internal consumption, which is estimated as 10 000 metric tons.

X. — World's Production of Sulphate of Copper.

Country	1912	1913	1st half-year 1914
	metric tons	metric tons	metric tons
United Kingdom	85 500	76 843	63 261
Italy	52 312	29 217	.....
United States	17 908	24 643	.....
France	26 000	26 000	.....
Austria-Hungary	15 200	15 400	.....
Germany	5 942	5 682	.....
Other countries (Sweden, etc.)	1 000	1 000	.....
Total...	203 862	178 785	.....

The figures given for the United Kingdom are those of exports, which are approximately equal to the production. For Ireland the following figures have been obtained :

	Imports		Exports	
1912	2 899	metric tons	14.2	metric tons
1913	4 780	"	3	"

INTERNATIONAL TRADE.

The data given below are drawn from the customs returns of imports and exports for each country and represent what is commonly termed the special trade of imports and exports (see : Inst. Int. d'Agr., Publications du Bureau de la Statistique Générale, No. 4, *Notes sur les Statistiques du Commerce extérieur dans les différents pays*, 1914). The figures referring to similar or almost similar classes of material in the returns have been collected into tables with various headings, qualifying notes being made where necessary.

The fiscal year in Canada ending in March, the figures for the two years ending in March 1913 and 1914 are given under 1912 and 1913 respectively. The same applies to British India.

Phosphatic Manures.

I. — Imports and Exports of Natural Phosphates.

Country	Imports			Exports		
	1912	1913	1st half-year 1914	1912	1913	1st half-year 1914
	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons
Germany	902 824	928 798	420 165	7 032	6 885	732
Austria-Hungary	175 831	212 003	128 180	.....	.....	.....
Belgium	244 221	244 765	113 668	22 916	18 158	10 988
Denmark	45 710	55 875	.....	.....	.....	.....
Egypt	.....	.....	.....	52 115	64 183	.....
Spain	176 183	254 463	.....	.....	.....	.....
United States	.....	.....	.....	1 225 824	1 388 362	.....
France	907 845	934 679	472 554	22 062	21 128	7 997
Algeria	.....	.....	.....	377 601	438 601	239 690
Tunis	1 910 198	.....	.....	.....	.....	.....
Great Britain / Ireland	528 591	547 640	279 544	4 492	11 808	26 466
Australia	.....	162 599	.....	.....	943	.....
Canada	12 509	8 406	.....	.....	190	.....
Union of South Africa	.....	691	.....	.....	.....	.....
Italy	466 144	529 776	.....	1 285	4 171	.....
Japan	286 984	333 916	.....	.....	.....	.....
Norway	.....	.....	.....	1	.....	.....
Netherlands	60 161	.....	.....	5 708	.....	.....
Russia	47 421	.....	.....	.....	.....	.....
Sweden	81 574	110 450	.....	.....	.....	.....
Switzerland	17 821	18 885	.....	.....	.....	.....

II. — Imports and Exports of Basic Slag.

Country	Imports			Exports		
	1912	1913	1st half-year 1914	1912	1913	1st half-year 1914
	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons
Germany	372 835	441 069	234 081	663 024	713 878	307 106
Austria-Hungary	203 536	212 788	110 153	3 607	2 007	950
Belgium	130 439	144 553	76 248	550 847	685 907	335 016
Denmark	9 948	8 957	.....	.....	.....	.....
France	59 870	41 010	17 933	248 840	246 271	95 762
Great Britain	—	—	663 643	—	—	2 312 643
Ireland	50 102	51 951	13 450	159 689	167 742	70 249
Canada fr.	47 899	33 042	.....	.....	.....	.....
Union of South Afr c.	.....	5 416	.....	.....	.....	.....
Italy	118 190	119 257	4 727	14	103	.....
Japan	245	17	.....	.....	.....	.....
Norway	40 257	34 492	.....	.....	.....	.....
Netherlands	339 968	.....	.....	154 483	.....	.....
Russia	170 340	.....	.....	.....	.....	.....
Sweden	21 047	19 243	.....	.....	.....	.....
Switzerland	54 182	55 793	.....	.....	.....	.....

The first set of figures for France are those given under the heading of " machefer " in the returns ; when ground, the same material was entered under the heading " engrais chimique " till the end of 1913, so that the figures only referred to a portion of the trade in slag ; for the first half of 1914 the imports and exports of ground slag are given separately in the second set of figures.

III. — Imports and Exports of Superphosphate.

Country	Imports			Exports		
	1912	1913	1st half-year 1914	1912	1913	1st half-year 1914
	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons
Germany	62 399	53 193	29 225	271 349	282 653	192 145
Austria-Hungary	79 531	75 224	43 993	5 354	3 748	1 971
Belgium	37 802	28 012	31 435	314 713	318 922	171 390
Denmark	102 135	110 155	.....	.....	.....	.....
Egypt	11 459	13 148	.....	.....	.....	.....
Spain	161 047	149 602	.....	.....	.....	.....
France	89 059	100 822	55 768	169 617	145 236	72 001
Algeria	28 183	18 164	1 284	3 329	8 006	.....
Great Britain / Ireland	.....	.....	.....	90 314	64 496	28 534
Australia	.....	27 138	.....	.....	120 881	.....
Canada	878	966	.....	.....	.....	.....
Union of South Africa	.....	37 207	.....	.....	.....	.....
Japan	254	977	.....	25 705	16 885	.....
Mexico	.....	60	.....	.....	.....	.....
Norway	8 543	4 283	.....	.....	.....	.....
Netherlands	295 613	.....	.....	346 186	.....	.....
Russia	188 244	.....	.....	.....	.....	.....
Sweden	9 815	.....	.....	57 807	36 037	.....

In many countries, such as Italy and certain colonies, where the use of fertilizers is still very limited, superphosphate is included under the general heading of "chemical fertilizers" in the returns and therefore does not appear in the above table.

IV. — Imports and Exports of Guano.

Country	Imports			Exports		
	1912	1913	1st half-year 1914	1912	1913	1st half-year 1914
	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons
Germany	28 659	35 299	14 283	844	136	182
	18 509	26 620	4 886	6 140	5 691	3 138
Argentine Republic	.....	.....	.....	24 078	28 630	.....
Belgium	15 166	49 541	11 099	31 697	29 446	14 979
Chile	509	.....	.....	.....	.....	.....
Spain	2 486	1 781	.....	.....	.....	.....
United States	19 467	19 411	.....	.....	.....	.....
France	311	1 376	.....	403	317	.....
Great Britain Ireland	14 341	25 957	14 857	.....	.....	.....
Australia	.....	1 362	.....	.....	317	.....
Canada	1 896	3 289	.....	.....	.....	.....
British India	13	93	.....	18 650	21 750	.....
New Zealand	13 574	.....	.....	.....	.....	.....
Union of South Africa	.....	318	.....	.....	.....	.....
Italy	195	111	12	.....	.....	.....
Norway	.....	.....	.....	10 693	13 063	.....
Netherlands	13 890	22 317	.....	11 046	10 968	.....
Sweden	187	.....	.....	454	.....	.....
Switzerland	112	72	.....	.....	.....	.....

The first set of figures for Germany refer to natural guano, the second to artificial guano and similar products. The exports from the Argentine consist of meat guano, while those from British India, Norway and the greater part from Sweden are fish guano. South Africa, over and above its official imports, received 6 993 and 4 830 metric tons of guano from the coastal islands during 1913 and the first half of 1914 respectively.

V. — Imports and Exports of Bones and Bone Manures.

Country	Imports			Exports		
	1912	1913	1st half-year 1914	1912	1913	1st half-year 1914
	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons
Germany	16 343	24 481	13 731	7 870	6 514	3 219
	36 842	30 845	11 035	28 925	32 474	19 335
Argentine Republic	.....	.....	.....	30 451	30 716	.....
	.....	.....	.....	1 427	895	.....
Austria-Hungary	13 336	7 080	.....	10 193	9 582	.....
Belgium	41 656	45 509	21 110	16 365	22 748	18 844
Chile	.....	.....	.....	1 730	.....	.....
	.....	.....	.....	38	.....	.....
China	.....	.....	.....	29 976	.....	.....
Denmark	120	.....	.....	34	.....	.....
Turkey	28	.....	.....	4 794	.....	.....
Egypt	.....	.....	.....	4 310	3 747	.....
United States	34 703	35 173	.....	.....	.....	.....
France	38 095	36 768	22 444	10 973	.....	10 152
	892	2 627	381	977	499	476
Algeria	.....	.....	.....	1 656	1 774	.....
Great Britain Ireland	41 862	41 336	20 002	.....	.....	.....
Australia	.....	.....	.....	.....	4 384	.....
Canada	1 204	2 207	.....	9	3 311	.....
	3 839	3 890	.....	.....	.....	.....
British India	52	.....	.....	111 984	107 100	.....
New Zealand	.....	.....	.....	21	.....	.....
	10 677	.....	.....	13	.....	.....
Union of South Africa	.....	4 276	.....	.....	.....	.....
Greece	.....	.....	.....	300	.....	.....
Italy	4 193	5 630	2 115	3 630	7 028	3 642
Japan	39 302	47 894	.....	.....	.....	.....
Norway	.....	.....	.....	863	1 217	.....
Russia	1 230	.....	.....	.....	.....	.....
Servia	78	.....	.....	478	.....	.....
Sweden	4 475	.....	.....	283	.....	.....
Uruguay	.....	.....	.....	4 527	.....	.....
	.....	.....	.....	5 755	.....	.....

Where two sets of figures are given for any country, the first set refer to raw bones and the second to treated bones, such as bone flour, bone ash, calcined bones.

Potassic Fertilizers.

VI. — Imports and Exports of Potash Salts.

Country		Imports			Exports		
		1912	1913	1st half-year 1914	1912	1913	1st half-year 1914
		metric tons	metric tons	metric tons	metric tons	metric tons	metric tons
Germany	*a*	—	—	—	1 300 459	1 676 156	727 042
	b	43	44	52	85 479	133 358	50 061
	c	46	15	30	286 614	393 320	159 348
Austria-Hungary	*a*	97 721	110 069	54 330	1 572	1 774	1 155
	b	13	19	6	800	1 474	845
		5 280	5 216	1 889	855	1 317	697
Chile	*a*	49	—	—	.....	.....	.....
Denmark	*a*	25 887	24 667	—	.....	.....	.....
United States	*a*	694 133	600 168	—	.....	.....	.....
	b	44 071	40 172	—	.....	.....	.....
	c	218 751	217 191	11 335	620	708	448
France	*b*	17 805	11 284	30 006	271	134	61
	c	45 174	46 137	—	.....	.....	.....
Ireland	*a*	19 313	17 781	—	.....	.....	.....
	b	442	414	—	.....	.....	.....
	c	1 204	1 173	—	.....	.....	.....
Canada	*a*	19	180	—	.....	.....	.....
	b	4 781	6 957	—	.....	.....	.....
Union of South Africa	*a*	—	1 812	—	.....	.....	.....
Greece	*c*	276	—	—	.....	.....	.....
Italy	*b*	13 466	9 839	2 059	2.5	0.7	.....
	c	8 153	7 154	3 246	0.1	.....	0.5
Japan	*a*	81	—	50	.....	.....	.....
Mexico	*b*	—	10	50	.....	.....	.....
	c	—	81	—	.....	.....	.....
Norway	*a*	21 304	21 084	—	.....	.....	.....
Russia	*a*	83 131	—	—	.....	.....	.....
	c	5 995	—	—	.....	.....	.....
Sweden	*a*	85 776	80 253	—	.....	.....	.....
Switzerland	*a*	15 006	13 241	—	.....	.....	.....
	c	1 572	1 572	—	.....	.....	.....

The sets of figures classified as *a* refer to substances designated as "potash manure salts"; those under *b* to substances designated as "sulphate of potash"; those under *c* to substances designated as "muriate of potash". This classification is not, however, always very exact; for example in Italy kainite and other manure salts are included under *b*. The exports for Germany for 1913 are rather high, as they include a part of those for 1912.

The only potassic fertilizer classified separately in the United Kingdom is nitrate of potash (see Part 2, Table VIII, p. 1116) the rest are returned under the heading of unenumerated manures.

VII. — Imports and Exports of Other Potash Manures.

Country	Imports			Exports		
	1912	1913	1st half-year 1914	1912	1913	1st half-year 1914
	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons
Germany	597	402	276	14 450	16 058	7 551
Chili	86	.....	.....	.....	.....	.....
China	3 886	.....	.....	.....	.....	.....
France	53	71	291	952	708	412
	1 293	3 597	1 400	3 719	1 586	1 559
Great Britain / Ireland	11 034	12 084	6 273	1 935	1 723	74
Canada	840	938	.....	.....	.....	.....
(barrels)	.....	.....	.....	550	434	.....
British India	3	.....	.....	15 076	13 618	.....
New Zealand	998	.....	.....	.....	.....	.....
Greece	2 576	.....	.....	.....	.....	.....
Italy	461	458	209	3	6	.....
Japan	.....	10	.....	.....	.....	.....
	418	522	.....	.....	.....	.....
Norway	.....	.....	.....	1 784	2 521	.....
	.....	.....	.....	32 844	32 796	.....
	.....	.....	.....	7 000	53 047	.....
Netherlands	4 312	6 721	.....	7 407	6 243	.....
Servia	352	.....	.....	.....	.....	.....
Sweden	.....	.....	.....	34 643	37 655	.....

The product referred to in this table is nitrate of potash except in the following cases :

1. The second set of figures for France, which refer to beet potash.
2. The second set of figures for Canada which refer to wood ashes.
3. ,, ,, ,, ,, ,, Norway ,, ,, kelp ash.
4. The third ,, ,, ,, ,, ,, ,, felspar.
5. The fourth ,, ,, ,, ,, ,, ,, ground felspar.
6. The single ,, ,, ,, Sweden ,, ,, felspar.

Nitrogenous Manures.

VIII. — Imports and Exports of Nitrate of Soda.

Country	Imports			Exports		
	1912	1913	1st half-year 1914	1912	1913	1st half-year 1914
	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons
Germany	812 898	774 299	589 854	27 431	27 557	23 324
Argentine Republic	373	649	.....	.....	.....	.....
Austria-Hungary	92 838	93 025	62 733	403	313	580
Belgium	235 382	304 136	164 598	122 668	13 999	88 195
Chile	.....	.....	.....	2 498 529	.....	.....
Denmark	36 402	35 024	.....	.....	.....	.....
Egypt	56 047	56 474	.....	.....	.....	.....
Spain	46 715	35 557	.....	.....	.....	.....
United States	444 134	635 876	.....	.....	.....	.....
France	353 776	322 115	232 813	10 233	5 268	1 879
Great Britain / Ireland	125 557	143 181	66 822	.....	.....	.....
Australia	.....	3 393	.....	.....	516	.....
Canada	39 714	36 406	.....	.....	.....	.....
Union of South Africa	.....	66	.....	.....	.....	.....
Italy	54 654	67 418	58 405	27	50	170
Japan	85 271	112 405	.....	.....	.....	.....
Norway	1 130	1 337	.....	184	811	.....
Netherlands	204 169	202 928	.....	129 763	121 096	.....
Russia	50 630	.....	.....	.....	.....	.....
Servia	135	.....	.....	.....	.....	.....
Sweden	35 107	33 892	.....	.....	.....	.....
Switzerland	3 162	3 328	.....	37	29	.....

The official figures given above do not agree with those published by the Nitrate Association, which are based on commercial data and therefore do not represent exactly exports and imports (see Bertrand, A., Circular No. 60 de la Asociacion Salitrera, p. 206).

For many countries no figures can be given as special returns for nitrate are not made, or are published with too great a delay.

IX. — Imports and Exports of Sulphate of Ammonia.

Country	Imports			Exports		
	1912	1913	1st half-year 1914	1912	1913	1st half-year 1914
	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons
Germany	23 098	34 627	22 528	57 267	75 868	74 723
Austria-Hungary	21	51	28	20 818	23 816	20 210
Belgium	20 062	24 199	22 976	17 886	41 382	17 239
Denmark	.....	.....	.....	2 415	2 329	.....
Egypt	651	1 650	.....	.....	.....	.....
United States	54 015	59 670	.....	.....	.....	.....
France	22 892	22 995	7 764	1 976	1 151	827
Great Britain, Ireland	.....	.....	.....	289 512	328 223	167 075
Australia	.....	792	.....	.....	2 340	.....
Canada	219	159	.....	.....	.....	.....
Union of South Africa	.....	362	.....	.....	.....	.....
Italy	21 190	21 669	8 253	4	55	8
Japan	93 416	26 938	.....	.....	.....	.....
Mexico	.....	63	19	.....	.....	.....
Norway	.....	.....	.....	175	138	.....
Netherlands	39 275	.....	.....	31 317	.....	.....
Servia	76	136	52	.....	.....	.....
Sweden	46	.....	.....	41	.....	.....

This table is incomplete, especially with regard to imports in the colonies. Such data may be found in the export returns of the United Kingdom, Belgium (Antwerp), Netherlands (Rotterdam), and now also in those of Germany which has started a considerable export trade to Italy, the Dutch Indies, etc. (see Inst. Int. d'Agr. *Production et Consommation des Engrais Chimiques dans le Monde*).

X. — Imports and Exports of Synthetic Nitrogenous Fertilizers.

Country	Imports			Exports		
	1912	1913	1st half-year 1914	1912	1913	1st half-year 1914
	mteric tons	metric tons	metric tons	metric tons	metric tons	metric tons
Germany	44 612	54 378	31 038	8 134	30 466	22 440
Denmark	412	5 066	.....	.....	.....	.....
Egypt	728	971	.....	.....	.....	.....
United States	2 339	.....	.....	.....	.....	.....
France	3 160	10 010	1 531	789	839	320
Algeria	766	1 091	458	.....	.....	.....
Canada	737	1 167	.....	.....	.....	.....
Mexico	.....	.....	2.5	.....	.....	.....
Norway	.....	.....	.....	4 270	7 807	.....
	.....	.....	.....	51 701	70 171	.....
	.....	.....	.....	13 892	22 111	.....
Sweden	8	.....	.....	.....	.....	.....
	176	.....	.....	0.4	.....	.....
	0.2	.....	.....	4 058	.....	.....

The imports of Egypt consist only of calcium cyanamide, those of the United States only of nitrate of lime and those of Canada only of nitrate of ammonia, but the latter are probably not put to agricultural use.

The first, second and third sets of figures for Norway and Sweden refer to nitrate of ammonia, nitrate of lime and calcium cyanamide respectively. Figures for the exports of Norway during the first quarter of 1914 are as follows:

2 771 metric tons of nitrate of ammonia
19 636 „ „ „ „ „ lime
9 838 „ „ „ calcium cyanamide.

XI. — Exports and Imports of Organic Nitrogenous Fertilizers.

Country	Imports			Exports		
	1912	1913	1st half-year 1914	1912	1913	1st half-year 1914
	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons
Germany	3 261	2 899	1 373	5 307	6 704	3 941
	57 930	64 421	35 636	12 022	15 781	9 866
Argentine Republic	.....	.....	.....	13 858	12 782	.....
Austria-Hungary	893	560	217	3 647	3 444	1 589
	1 237	1 667	963	777	654	388
China	140 307	.....	.....	51 066	.....	.....
	.....	.....	.....	493 477	.....	.....
Egypt	.....	.....	.....	.....	75	.....
	.....	.....	.....	80 778	62 977	.....
France	72 573	82 072	33 835	31 365	30 728	15 079
British India	19	464	.....	164 380	178 126	.....
Japan	623 471	373 800	.....	.....	.....	.....
Norway	.....	.....	.....	14 548	8 929	.....
Switzerland	145	136	.....	652	1 626	.....
	2 190	2 053	.....	1 354	1 579	.....
Uruguay	.....	.....	.....	137 559	.....	.....

The first set of figures for Germany, Austria-Hungary and Switzerland refer exclusively to horns and hoofs for manurial use; the second set refer to other animal residues, blood, etc. The figures for the Argentine Republic and Uruguay represent the total slaughterhouse residues excluding meat guanos and bones, which are given elsewhere.

The exports and imports for China, Egypt and India consist entirely of oil cakes with the exception of a small export of other material from Egypt shown in the first figure for 1913. Soya bean exports from China are classified separately in the second set of figures for 1912. It should be noted that oil cakes are largely but by no means exclusively used for manure in India.

Other Fertilizers and Chemical Products used in Agriculture.

XII. — IMPORTS AND EXPORTS OF UNENUMERATED CHEMICAL FERTILIZERS.

Country	Imports			Exports		
	1912	1913	1st half-year 1914	1912	1913	1st half-year 1914
	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons
Argentine Republic ..	381	546	.....	.....	.....	.....
Chile	52	.....	.....	.....	.....	.....
China	49 647	.....	.....	.....	.....	.....
Egypt	61	245	.....	.....	.....	.....
United States.....	.....	.....	.....	75 780	73 911	.....
France.....	147 495	223 217	66 364	306 975	403 305	7 971
Algeria.....	9 493	10 291	.....	.....	.....	.....
Australia.....	.....	10 784	.....	.....	.....	.....
Canada .....fr.	279 806	312 060	.....	.....	.....	.....
British India.....	54 864	.....	.....	.....	.....	.....
Italy.....	37 032	71 729	15 372	9 243	19 310	14 094
Mexico	.....	80	75	.....	.....	.....
Servia	18	.....	.....	.....	.....	.....
Switzerland.....	25 926	26 309	.....	7 487	10 994	.....

The nature of the products varies with the different countries. In France, up to 1914, they included ground basic slag. In Italy the greater part of the superphosphate is included. In the United States the figures refer almost exclusively to compound manures exported more especially to other countries on the American continent (Canada, Mexico, etc.).

XIII. — Imports and Exports of Other Unclassified Manures.

Country	Imports			Exports		
	1912	1913	1st half-year 1914	1912	1913	1st half-year 1914
	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons
Belgium	42 085	43 038	18 326	54 414	56 868	23 039
Turkey	287	.....	.....	14 721	.....	.....
Spain	90 684	91 380	.....	14 143	24 869	.....
Great Britain, Ireland	170 592	175 643	91 217	135 224	154 876	79 437
Australia	.....	.....	.....	.....	12 077	.....
British India	288	.....	.....	8 471	.....	.....
New Zealand	78 782	.....	.....	112	.....	.....
Union of South Africa	.....	7 788	.....	.....	.....	.....
Greece	656	.....	.....	.....	.....	.....
Italy	19 640	12 651	10 416	19 977	28 670	1 692
Japan	85 914	134 397	.....	36 628	27 391	.....
Norway	1 958	1 172	.....	.....	.....	.....
Netherlands	1 579 332	1 635 566	.....	109 497	62 215	.....
Russia	15 168	.....	.....	.....	.....	.....

This last class of manures is still more heterogenous. In Great Britain and Spain it includes potash salts, while the Netherlands include all fertilizers except guano and nitrate of soda under the one heading in their monthly returns, though further classifications occur in their annual returns. In Italy the figures refer exclusively to organic manures amongst which olive and wine pomace have recently assumed some importance.

XIV. — Imports and Exports of Sulphur.

Country	Imports			Exports		
	1912	1913	1st half-year 1914	1912	1913	1st half-year 1914
	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons
Germany	42 284	46 737	29 772	1 746	3 472	2 653
Argentine Republic	4 549	3 125	.....	.....	.....	.....
Austria-Hungary	41 023	39 442	23 781	1 048	312	59
Belgium	15 647	11 724	4 193	10 498	6 745	4 399
China	1 322	.....	.....	.....	.....	.....
Denmark	.....	268	.....	.....	.....	.....
Turkey	4 768	.....	.....	57	.....	.....
Egypt	643	600	.....	.....	.....	.....
Spain	6 565	11 202	.....	4	2	.....
United States	27 315	14 870	.....	5 865	9 065	.....
France	172 181	186 348	82 842	39 694	23 325	12 695
Algeria	26 105	31 991	30 013	.....	.....	.....
Great Britain / Ireland	22 098	18 505	9 081	1 856	731	.....
Canada	32 983	27 085	.....	.....	.....	.....
British India	5 841	6 428	.....	.....	.....	.....
New Zealand	2 034	.....	.....	.....	.....	.....
Greece	8 714	.....	.....	.....	.....	.....
Italy	184	183	74	351 339	376 387	194 451
Japan	.....	.....	.....	49 131	54 256	.....
Norway	13 911	14 607	.....	.....	.....	.....
Netherlands	35 324	36 937	.....	14 341	10 216	.....
Servia	71	.....	.....	.....	.....	.....
Switzerland	3 358	3 562	.....	.....	.....	.....
Sweden	38 471	38 192	.....	.....	.....	.....

Sulphur under all forms (crude or refined) is included in the above table. It is imported chiefly by the countries in which vine or fruit growing is specially well developed.

XV. — Imports and Exports of Sulphate of Copper.

Country	Imports			Exports		
	1912	1913	1st half-year 1914	1912	1913	1st half-year 1914
	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons
Germany	7 074	3 864	4 448	3 812	4 012	3 533
Argentine Republic	1 376	1 288	.....	.....	.....	.....
Austria-Hungary	16 132	6 937	6 497	119	172	203
Chile	221	.....	.....	.....	.....	.....
Denmark	.....	249	.....	.....	.....	.....
Turkey	1 623	.....	.....	1.5	.....	.....
Spain	7 121	6 433	.....	1	2	.....
United States	.....	.....	.....	3 097	1 910	.....
France	16 801	21 575	21 734	6 904	5 312	5 377
Algeria	4 612	3 609	3 687	.....	.....	.....
Great Britain, Ireland	.....	.....	.....	84 124	76 843	63 261
Canada	1 152	605	.....	.....	.....	.....
Greece	2 524	.....	.....	.....	.....	.....
Italy	36 568	30 450	21 491	1 387	522	1 504
Servia	883	.....	.....	.....	.....	.....
Switzerland	2 873	2 103	.....	66	62	.....
Sweden	.....	.....	.....	513	250	.....

The international trade in sulphate of copper is becoming important; this product, like sulphur, is chiefly imported by those countries having large areas under fruit and vines.

THE CONSUMPTION OF FERTILIZERS IN THE DIFFERENT COUNTRIES.

I. — Movement in Denmark during 1913 of Fertilizers and Other Chemical Products for Agricultural Use.

Fertilizers	Imports	Exports	Consumption
	metric tons	metric tons	metric tons
Phosphatic fertilizers.			
Mineral phosphates	55 875	.....	55 875
Superphosphate	110 151	683	.....
Basic slag	8 944	.....	8 944
Bone flour	282	2	.....
Nitrogenous fertilizers.			
Synthetic products	5 066	.....	5 066
Nitrate of soda	34 930	.....	34 930
Sulphate of ammonia	524	2 830	.....
Potassic fertilizers.			
Kainite	9 400	.....	9 400
Others	16 700	.....	16 700
Lime, in lumps	5 079	2 085	.....
Lime, ground	1 411	3 357	.....
Marl	9 021	.....	.....
Manures from animal sources	85	105	.....
Sulphate of copper	249	.....	249
Sulphur	268	.....	268

The above data were collected by the Danish Office of the International Institute of Agriculture at Copenhagen.

II. — Consumption of Fertilizers in the United States during the years 1911-1913.

State	End of fiscal year	1911	1912	1913
		metric tons	metric tons	metric tons
Alabama	Oct. 1	399 161	410 243	430 668
*Arizona	—	317	454	544
*Arkansas	Dec. 31	36 287	45 359	47 174
California	June 30	45 087	45 359	32 659
*Colorado	—	2 268	2 722	3 175
*Connecticut	April 30	40 823	43 545	45 359
*Delaware	Dec. 31	22 680	27 215	45 359
Florida	» »	166 411	170 485	193 891
Georgia	Sept. 30	1 091 091	1 001 409	1 016 676
*Idaho	—	907	1 361	1 814
*Illinois	April 30	72 575	77 111	81 647
Indiana	Oct. 15	163 147	130 342	175 902
*Iowa	April 30	1 814	2 268	3 175
Kansas	Dec. 31	1 361	4 536	6 695
Kentucky	» »	58 967	58 967	68 039
Louisiana	Aug. 31	82 631	68 542	89 610
*Maine	Dec. 31	127 006	136 078	145 150
Maryland	» »	143 335	145 150	153 314
Massachusetts	» »	65 317	68 039	113 398
Michigan	» »	40 823	46 266	52 603
*Minnesota	» »	1 814	2 177	3 175
Mississippi	Oct. 1	134 478	108 599	116 165
Missouri	Dec. 31	37 816	34 799	54 431
Montana	—	544	635	726
*Nebraska	—	272	454	907
*Nevada	—	454	544	726
*New Hampshire	April 30	17 236	19 958	22 680
New Jersey	Oct. 31	122 470	127 006	142 120
*New Mexico	—	726	816	907
*New York	Dec. 31	362 874	385 554	417 305
North Carolina	» 1	645 353	631 133	762 441
*North Dakota	» 31	454	544	907
Ohio	» »	134 263	137 696	167 829
*Oklahoma	April 30	7 257	9 072	16 329
*Oregon	Aug. 31	2 722	3 175	4 082
Pennsylvania	Dec 31	285 763	289 134	308 443
Porto Rico	June 30	20 865	18 144	17 088
*Rhode Island	March 31	10 886	13 608	16 329
South Carolina	June 30	951 461	803 967	833 101
*South Dakota	July 1	181	272	635
Tennessee	June 1	58 967	70 282	76 258
Texas	Sept. 1	48 067	40 823	68 492
*Utah	Dec. 31	544	635	907
*Vermont	» »	18 144	19 958	22 680
Virginia	» »	326 101	337 571	374 154
*Washington	March 31	1 179	1 270	1 361
West Virginia	July 1	28 349	28 803	28 896
*Wisconsin	Dec. 31	2 268	3 175	3 629
*Wyoming	—	113	136	181
Total		5 783 636	5 575 392	6 169 736
Alaska	June 30		9	41
Hawaii	» »		63 500	60 000

* States in which there are no fertilizer laws.

The above figures are furnished by the Agricultural Experiment Stations in the various States ; in the States where there are no fertilizer laws (marked with an asterisk) the estimates are only approximative.

III. — Imports of Manures into Ceylon during the Fiscal year 1912-1913 compared with those of 1908.

Manure	1908			1912-13		
	Metric tons	Long tons	Price per long ton	Metric tons	Long tons	Price per long ton
			Rupees *			Rupees
Castor cake	7 082	6 971	56	4 257	4 190	88.8
Groundnut cake.....	—	—	—	15 877	15 627	87.1
Rape cake	—	—	—	1 510	1 486	40.5
Fish manure	74	73	57	21 058	20 726	57.0
Guano.....	10	10	120	3 720	3 661	98.0
Blood meal	—	—	—	2 653	2 611	171.0
Bone meal.....	4 789	4 714	55	6 750	6 644	83.5
Superphosphate	—	—	—	2 549	2 509	100.0
Basic slag	—	—	—	6 468	6 366	53.8
Sulphate of potash ..	55	54	166	5 163	5 082	145.0
Chloride of potash...	—	—	—	1 224	1 205	133.6
Kainit	—	—	—	1 651	1 625	51.6
Nitrate of potash ...	73	72	296	2 115	2 082	208.0
Refuse saltpetre	292	287	200	—	—	—
Sulphate of ammonia	137	135	296	2 466	2 427	254.0
Nitrate of soda.....	—	—	—	278	274	182.0
Other manures.....	459	452	167	4 163	4 097	105
Total...	12 972	12 768		81 902	80 612	

* 1 rupee = 1*s* 4*d*.

With a cultivated area of 2 800 000 acres (Statesman's Year-Book, 1914), the consumption of manure per acre is 54.5 lbs.

IV. — Consumption of Fertilizers in Australia.

	Metric tons	Long tons
ew South Wales (1912)	39 541	38 918
ctoria (1912)	95 514	94 010
ueensland (1913)	10 368	10 205
uth Australia (1912)	93 073	91 607
estern Australia (1912)	48 324	47 563
asmania (1912)	9 420	9 272
asmania (1913)	8 890	8 750
ederal Territory (1912)	851	838
orthern Territory (1912)	1	1

The figures were received from the Department of Foreign Affairs, ommonwealth of Australia.

V. — Consumption of Fertilizers in Japan.

Manure	1911			1912		
	Metric tons	Long tons	Value in yen *	Metric tons	Long tons	Value in yen
uperphosphate	266 992	262 788	7 672 105	424 003	417 326	11 721 277
uano	1 078	1 061	44 639	3 622	3 565	107 078
ones	35 888	35 323	2 174 583	35 726	35 164	2 321 479
otassic manures	1 089	1 072	64 498	1 331	1 310	72 168
itrate of soda	32 257	31 749	4 575 018	41 673	41 017	5 860 553
ulphate of ammonia	11 383	11 204	1 126 376	7 737	7 615	798 720
ynthetic nitrogenous fertilizers	297	292	30 682	5 199	5 117	516 650
ompound manures	208 469	205 186	14 308 988	237 880	234 134	16 862 526
ther manures	.....	.....	1 089 225	.....	.....	2 405 835

* 1 yen = 2s 0½d.

The figures were furnished by the Japanese Ministry of Agriculture and Commerce.

VI. — World's Consumption of Potassic Fertilizers for Agricultural Purposes (1).

Country	Potassic manures as K_2O in metric tons	
	1912	1913
Germany	463 383.6	536 102.6
Belgium	10 945.2	13 182.5
Netherlands	39 473.7	43 478.4
France	31 690.8	33 114.9
England	12 958.9	12 956.1
Scotland	7 182.9	7 150.8
Ireland	3 272.6	3 303.7
Luxemburg	284.0	401.9
Austria	18 873.4	20 974.3
Hungary	3 736.4	4 098.4
Switzerland	3 500.9	3 308.5
Italy	7 295.9	6 354.1
Russia	23 420.0	22 654.6
Spain	9 009.2	8 292.4
Portugal	1 134.4	1 241.2
Sweden	20 670.0	19 513.5
Norway	3 431.0	3 593.2
Denmark	6 006.0	7 477.6
Finland	1 422.4	1 605.6
Balkan States	371.1	198.3
Europe	668 062.4	749 002.6
British India	812.4	1 084.7
Ceylon	3 210.9	2 647.6
Straits Settlements	65.2	15.6
Java	355.2	153.7
Sumatra	413.4	411.5
Celebes	—	0.3
Indo-China	21.8	24.8
China	18.9	63.4
Japan	792.2	1 179.7
Philippine Islands	63.0	75.0
Turkestan	—	—
Asia Minor, Palestine	70.9	54.0
Asia	5 823.9	5 710.3
Marocco	—	—
Algeria	1 289.8	1 459.7
Tunis	40.5	38.1
Egypt	84.8	72.5
Carried forward	1 415.1	1 570.3

(1) Figures supplied by the German Potash Syndicate.

VI. — World's Consumption of Potassic Fertilizers for Agricultural Purposes (*continued*).

Country	Potassic manures as K_2O in metric tons	
	1912	1913
Brought forward.....	1 415.1	1 570.3
Union of South Africa.....	456.9	1 018.1
German Colonies in Africa.....	230.1	285.8
Angola.....	1.3	0.2
French Congo.....	.....	.....
Belgian Congo.....	10.8	.....
Nigeria.....	.....	.....
Canary Islands.....	688.6	1 109.3
Azores.....	6.9	12.4
Madeira.....	67.9	118.5
Mauritius and Reunion.....	185.8	126.1
Seychelles.....	.....	.....
Fernando Po.....	.....	.....
S. Thomé and Principe Is.....	77.6	129.4
AFRICA.....	3 141.0	4 370.1
United States.....	215 965.7	231 689.6
Canada.....	279.2	1 375.3
Mexico.....	108.7	91.3
Central America.....	243.4	278.5
West Indies.....	1 840.4	2 481.2
Hawaii.....	2 952.3	3 818.8
Brazil.....	1 104.5	1 270.9
Paraguay.....	.....	.....
Uruguay.....	13.2	20.1
Argentine Republic.....	21.1	33.3
Chile.....	210.5	202.7
Bolivia.....	.....	.....
Peru.....	1 315.8	1 004.3
Equador.....	.....	0.1
Colombia.....	17.5	4.3
Venezuela.....	0.1	.....
British Guiana.....	3.2	12.8
Dutch Guiana.....	.....	0.1
AMERICA.....	224 075.6	242 283.3
AUSTRALIA.....	2 621.1	2 490.4
POLYNESIA.....	35.0	56.5
TOTAL.....	903 759.0	1 003 913.2

VII. — World's Consumption of Nitrate of Soda. (1).

Country	1912	1913
	metric tons	metric tons
England	101 080.6	94 360.6
Scotland	36 333.9	34 200.9
Germany	911 962.2	833 112.5
France	354 517.4	327 191.8
Belgium	309 817.0	318 514.8
Netherlands	180 924.2	164 501.9
Italy	44 545.1	51 689.7
Austria-Hungary	7 113.5	7 444.9
Denmark	4 825.2	10 748.0
Switzerland	5 198.0	—
Spain	13 554.0	13 150.2
Egypt	23 981.0	25 637.7
	1 993 852.1	1 880 553.2
United States	441 047.0	589 186.7
Other countries	93 376.9	84 020.8
Chile	2 368.5	3 212.3
Total	2 530 644.5	2 556 971.0

VIII. — Consumption of Nitrogen for Agricultural Purposes in Various Countries, 1913 (2).

Country	Nitrate of soda		Sulphate of ammonia	
	Amount consumed	Nitrogen in amount consumed	Amount consumed	Nitrogen in amount consumed
	metric tons	metric tons	metric tons	metric tons
Germany	497 860	74 679	460 000	94 300
United Kingdon	133 000	19 950	97 000	19 885
France	355 000	53 250	90 000	18 450
Spain	13 800	2 070	57 000	11 685
Italy	44 600	6 690	29 500	6 047.5
Austria-Hungary	7 150	1 072.5	16 000	3 280
Belgium	308 200	46 230	42 000	8 610
Netherlands	183 000	27 450	8 000	1 640
Sweden	5 220	783	1 350	277
Denmark	4 900	735	700	134
Egypt	23 800	3 570	2 000	410
United States	485 000	72 750	235 000	48 175
Japan	21 700	3 255	115 000	23 575
Dutch Indies (Java)	15 000	2 250	57 000	11 685

(1) Figures supplied by the Chilean Nitrate Propaganda.
(2) Figures supplied by the Deutsche Ammoniak-Vereinigung.

IX. — Sulphur Exported from Sicily (1).

Country of destination	1913					Tota	1st half-year 1914					Total
	Crude		Refined		Subli-mated		Crude		Refined		Subli-mated	
	in loaves	ground	in loaves	ground			in loaves	ground	in loaves	ground		
	m. tons	m. tons	m. tons	m. tons	m. tons	m. tons	m. tons	m. tons	m. tons	m. tons	m. tons	m. tons
Italy	24 502	1 346	22 507	32 524	595	81 474	17 007	2 255	14 648	33 094	339	67 343
Austria	19 571	128	11 554	4 722	360	36 335	11 701	44	4 377	6 268	61	22 451
Belgium	9 047	65	3 170	990	48	13 320	3 195	.....	291	617	.....	4 103
Denmark	.....	.....	14	201	90	305	.....	.....	3	63	20	86
France	75 062	.....	111	13	.....	75 186	52 114	1	9	214	38	52 376
Germany	9 565	35	10 779	11 217	372	31 968	6 896	.....	4 140	4 247	28	15 311
Greece	.....	705	42	13 350	518	14 615	.....	890	114	14 682	.....	15 686
United Kingdom	7 637	77	2 543	5 558	221	16 036	1 959	.....	1 168	4 096	10	7 233
Norway	1 425	.....	5 637	1 200	.....	8 262	.....	.....	1 623	395	.....	2 018
Netherlands	1 195	10	1 002	6 702	66	8 975	42	.....	1 732	5 580	107	7 461
Portugal	3 003	.....	53	11 423	278	14 757	1 402	507	2	6 504	11	8 426
Russia	22 173	26	1 565	1 910	218	25 892	14 676	5	564	1 699	129	17 073
Rumania	2 700	.....	771	239	.....	3 710	1 495	.....	167	413	.....	2 075
Spain	1 350	601	1 040	3 257	436	6 684	903	376	742	6 804	42	8 867
Sweden	19 378	.....	54	110	.....	19 542	785	.....	83	25	.....	893
Turkey in Europe	.....	3	299	1 597	12	1 911	.....	.....	114	1 057	4	1 175
Canada	.....	.....	.....	.....	.....	.....	.....	.....	.....	388	.....	388
United States	15	.....	134	862	17	1 028	.....	.....	165	554	.....	719
Argentine Republic	2 062	202	722	583	410	3 979	.....	.....	60	13	.....	73
Brazil	951	.....	893	527	54	2 425	20	.....	44	148	.....	212
Chile	.....	.....	.....	520	192	712	.....	.....	.....	96	.....	96
Colombia	.....	.....	.....	.....	51	51	.....	.....	.....	.....	.....	.....
Mexico	.....	.....	38	87	.....	125	.....	.....	20	.....	.....	20
Peru	.....	.....	28	20	.....	48	.....	.....	4	.....	.....	4
Venezuela	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Egypt	.....	.....	31	584	.....	615	.....	.....	28	316	.....	344
Algeria	2 370	.....	.....	.....	.....	2 370	525	.....	1	.....	.....	526
Tunis	345	65	13	68	382	872	190	8	17	303	314	832
Union of South africa	12 600	.....	67	1 030	44	13 741	2 060	.....	101	193	.....	2 354
Turkey in Asia	.....	3	42	3 501	50	3 596	.....	2	45	3 492	293	3 832
British India	980	92	1 446	3 151	67	5 736	780	.....	722	835	.....	2 337
Australia	12 549	.....	341	551	.....	14 441	1 591	.....	3	.....	.....	1 594
Other countries	50	.....	2 157	4 137	305	6 649	1 582	.....	2 167	1 152	6	4 907
Total	228 530	3 357	63 053	110 634	4 787	415 378	118 923	4 088	33 154	93 248	1 402	250 815
Mean value	£4 18s 4d	£4 10s 7d	£4 6s 11d	£4 17s 0d	£5 11s 6d	£4 5s 4d	£4 18s 10d	£4 10s 7d	£4 6s 11d	£4 17s 0d	£4 5s 10d	£4 5s 10d

(1) Figures supplied by the « Consorzio solferino siciliano ».

PRICES OF PHOSPHATES, POTASH SALTS AND NITROGENOUS FERTILIZERS DURING THE FIRST HALF-YEAR, 1914.

Phosphates.

N. B. — *European prices are quoted per unit of 22.4 lbs.*
American prices are quoted per long ton.

I. — Tunisian Phosphate, 58-63 per cent. (nominal quotations).

Markets	Mediterranean	United Kingdom	North Sea	Baltic
	d	*d*	*d*	*d*
End of January 1914	5	5	5 1/8	5 3/8
» February 1914	4 3/4	4 3/4	4 7/8	5 1/8
» March 1914	4 3/4	4 3/4	4 7/8	5 1/8
» April 1914	4 3/4	4 3/4	4 7/8	5 1/8
» May 1914	4 3/4	4 3/4	4 7/8	5 1/8
» June 1914	4 3/4	4 3/4	4 7/8	5 1/8

II. — Algerian Phosphate 63-70 per cent (nominal quotations).

Markets	Mediterranean	United Kingdom	North Sea	Baltic
	d	*d*	*d*	*d*
End of January 1914	5 1/4	5 1/4	5 3/8	5 5/8
» February 1914	5	5	5 1/8	5 3/8
» March 1914	5	5	5 1/8	5 3/8
» April 1914	5 1/4	5 3/8	5 3/8	5 1/2
» May 1914	5 1/4	5 3/8	5 3/8	5 1/2
» June 1914	5 1/4	5 3/8	5 3/8	5 1/2

III. — ALGERIAN PHOSPHATE, 58-63 PER CENT (nominal quotations).

Markets	Mediterranean	United Kingdom	North Sea	Baltic
	d	*d*	*d*	*d*
End of January 1914.....	5	5	5 1/8	5 3/4
» » February »	4 3/4	4 3/4	4 7/8	5 1/8
» » March »	4 3/4	4 3/4	4 7/8	5 1/8
» » April »	4 3/4	4 3/4	4 7/8	5 1/8
» » May »	4 3/4	4 3/4	4 7/8	5 1/8
» » June »	4 3/4	4 3/4	4 7/8	5 1/8

IV. — FLORIDA HARD ROCK, 77-80 PER CENT (European quotations nominal, American quotations f. o. b. Florida).

Markets	New York	Mediterranean	United Kingdom	North Sea	Baltic
	$	*d*	*d*	*d*	*d*
End of January 1914	5.75–6.25	7 1/4	6 3/4	6 3/4	7
» » February »	5.75–6.25	7	6 1/2	6 1/2	6 3/4
» » March »	5.75–6.25	7	6 1/2	6 1/2	6 3/4
» » April »	5.75–6.25	6 3/4	6 3/8	6 1/2	6 3/4
» » May »	5.75–6.25	6 3/4	6 1/4	6 3/8	6 3/4
» » June »	5.75–6.25	6 3/4	6 1/4	6 3/8	6 3/4

V. — FLORIDA LAND PEBBLE, 68-73 PER CENT.
(European quotations nominal, American quotations f. o. b. Florida).

Markets	New York	Mediterranean	United Kingdom	North Sea	Baltic
	$	*d*	*d*	*d*	*d*
End of January 1914	3.00–3.25	5 5/8	5 1/8	5 1/8	5 3/8
» » February »	3.00–3.25	5 1/2	5	5	5 1/4
» » March »	3.00–3.25	5 1/2	5	5	5 1/4
» » April »	3.00–3.25	5 1/2	5	5	5 1/4
» » May »	3.00–3.25	5 1/2	5	5	5 1/4
» » June »	3.00–3.25	5 1/2	5	5	5 1/4

VI. — South Carolina Phosphate, 55-60 per cent.

(European quotations nominal, American quotations f. o. b. Mt. Pleasant

Markets	New York	Mediterranean	United Kingdom	North Sea	Baltic
	$	d	d	d	d
End of January 1914...	3.50–3.75	5	4 3/4	4 3/4	4 7/8
» February » ...	3.50–3.75	5	4 3/4	4 3/4	4 7/8
» March » ...	3.50–3.75	5	4 3/4	4 3/4	4 7/8
» April » ...	3.50–3.75	5	4 3/4	4 3/4	4 7/8
» May » ...	3.50–.375	5	4 3/4	4 3/4	4 7/8
» June » ...	3.50–3.75	5	4 3/4	4 3/4	4 7/8

VII. — Tennessee Phosphate, 78-80 per cent.

(European quotations nominal, American quotations f. o. b. Mt. Pleasant

Market	New York	Mediterranean	United Kingdom	North Sea	Baltic
	$	d	d	d	d
End of January 1914 ..	5.00–5.50	7	6 1/2	6 1/2	6 3/4
» February » ..	5.00–5.50	6 3/4	6 1/4	6 1/4	6 1/2
» March » ..	5.00–5.50	6 3/4	6 1/4	6 1/4	6 1/2
» April » ..	5.00–5.50	6 3/4	6 1/4	6 1/4	6 1/2
» May » ..	5.00–5.50	6 3/4	6 1/4	6 1/4	6 1/2
» June » ..	5.00–5.50	6 3/4	6 1/4	6 1/4	6 1/2

VIII. — Christmas Island Phosphate (nominal quotations).

Market	Mediterranean	United Kingdom	North Sea	Baltic
	d	d	d	d
End of January 1914.....	8 1/	8	8 1/4	8 1/4
» February »	8	7 3/4	8	8
» March »	8	7 3/4	8	8
» April »	8 1/4	8	8	8
» May »	8 1/4	8	8	8
» June »	8 1/4	8	8	8

IX. — Ocean Island Phosphate (nominal quotations).

Markets	Mediterranean	United Kingdom	North Sea	Baltic
	d	*d*	*d*	*d*
End of January 1914	8 1/4	8	8 1/4	8 1/4
» » February »	8	7 3/4	8	8
» » March »	8	7 3/4	8	8
» » April »	8 1/4	8	8	8
» » May »	8 1/4	8	8	8
» » June »	8 1/4	8	8	8

Potash Salts.

X. — Maximum Prices for Potash Salts fixed by German Law.

	Potash content	Per unit of 22.4 lbs	
	per cent.	*s*	*d*
Carnallite	9–12 (ground)		10 1/4
Crude salts (kainite, hartsalz, sylvinite)	12–15 (ground)	1	0
Potash manure salts	20–22	1	4 3/4
» » »	30–32	1	5 1/2
» » »	40–42	1	6 1/2
Chloride of potash	50–60	2	8 1/4
» » »	above 60	2	10 5/8
Sulphate » »	above 42	3	5 7/8
» » » magnesia		3	1

XI. — Current Price of Potash Salts in Germany, calculated from Table X.

Nature of salts	Potash content	Price per ton		
	per cent.	£	s	d
Carnallite	9		7	7
»	10		8	6
»	11		9	4
Kainite (hartsalz or sylvinite)	12		12	0
» » »	13		13	0
» » »	14		14	0
» » »	15		15	0
Potash manure salts	20	1	8	0
» » »	21	1	9	6
» » »	22	1	10	10
» » »	30	2	3	3
» » »	31	2	4	8
» » »	32	2	6	2
» » »	40	3	1	8
» » »	41	3	3	2
» » »	42	3	5	0
Kainite, ground fine, special type for the destruction of weeds	.....		5 (extra)	0

The above prices (Tables X and XI) refer to fertilizers consumed in Germany. For other countries the prices are fixed each year at the beginning of the season and are reckoned as at Stassfurt, always at higher prices than the same fertilizers intended for home use.

XII. — Prices of Potash Salts at New York, January-June, 1914.

Nature of salts	Potash content	Price per long ton			
	per cent.	$	£	s	d
Kainite	12.4	8.36	1	14	4
Hartsalz	16	10.87	2	4	8
Potash manure salts	20	13.58	2	15	9
Double » »	48–53	25.04	5	2	10
Sulphate of potash	90–95	47.57	9	15	4
Cloride » »	80–85	41.65	8	11	6
» » »	95	40.75	8	7	4
» » »	98	39.07	8	0	6

The New York market prices are used by the experiment stations to value commercial fertilizers in the States in which the fertilizer trade is controlled.

Nitrogenous Fertilizers.

XIII. — Prices of Nitrate of Soda per long ton on the spot.

Markets *	Antwerp			Dunkirk			Genoa			Hamburg			Liverpool			New York			Rotterdam		
	£	s	d	£	s	d	£	s	d	£	s	d	£	s	d	£	s	d	£	s	d
January 1914.....	9	18	7	9	19	5	10	11	6	9	19	5	10	8	6	10	4	10	10	1	11
February »	10	6	3	10	9	6	10	11	6	10	9	5	10	10	0	10	4	10	10	10	10
March »	10	0	3	10	2	3	10	11	6	10	4	11	10	11	10	10	4	19	10	5	11
April »	9	8	6	9	10	2	10	4	5	9	9	0	10	6	3	10	4	10	9	12	0
May »	9	11	4	9	12	7	10	2	2	9	14	0	9	18	6	10	4	4	9	13	0
June »	9	13	4	9	18	7	10	2	2	9	10	0	9	17	6	9	17	11	9	15	0

* All quotations are for the end of the month except in the case of Liverpool which, gives average prices for the month.

XIV. — Prices of Sulphate of Ammonia per long ton on the spot.

Markets	Antwerp *Comptoir* end of the month			Genoa (end of the month)						Hull (middle of the month)			New York (end of the month)			Paris (end of the month)		
	£	s	d	£	s	d	£	s	d	£	s	d	£	s	d	£	s	d
January 1914 ...	12	19	10	13	7	11	–13	10	0	12	7	6	13	2	4	12	17	10
February » ...	13	1	10	13	5	11	–13	7	12	12	9	8	13	2	4	12	13	9
March » ...	13	1	10	13	3	10	–13	7	11	12	7	6	13	2	4	12	13	9
April » ...	11	17	8	12	17	10	–13	1	10	12	4	2	13	2	4	12	5	9
May » ...	10	17	6	12	9	9	–12	11	10	11	6	0	12	8	7	11	13	8
June » ...	11	1	7	12	7	9	–12	9	9	10	9	4	11	7	10	11	11	8

XV. — Wholesale Price of Nitrogen per Unit of 22.4 lbs at Antwerp.

Nitrogen contained in :	Nitrate of soda		Sulphate of ammonia		Calcium cyanamide		Nitrate of lime	
	s	d	s	d	s	d	s	d
End of January 1914.....	12	10	12	10	12	2	14	8
» February »	13	3	13	0	12	2	14	8
» March »	13	0	13	0	12	2	.....	
» April »	12	1	11	9	12	2	.....	
» May »	12	4	10	9	.....		.....	
» June »	12	5	10	11	.....		.....	

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FIRST PART.

ORIGINAL ARTICLES

Agricultural Education in Hungary

by

JÁNOS NYÁRÁDY.

Agricultural instruction in Hungary is given in the following special educational establishments :

Royal Veterinary College at Budapest.
Royal Agricultural College.
Agricultural Training Colleges for primary school teachers.
Schools of Practical Agriculture.
Royal Dairy School.
School for Dairymen.
Other schools for special branches.

There are further 28 lecturers from the Training Colleges acting as district organisers and advisors.

Royal Veterinary College at Budapest. — This institute : *a*) provides a course of instruction and training in veterinary science ; *b*) grants licenses to veterinary surgeons ; *c*) furthers the interests of veterinary science by observations and experiments ; *d*) provides expert opinion for questions of veterinary science and hygiene ; and *e*) obtains information for Government purposes or for the Law Courts on veterinary questions. The course lasts four years (eight terms) and students to be admitted require to have taken the school leaving examination of the middle schools ; terms kept in a foreign veterinary school of similar standard are recognised and the course leads to graduation with a doctor's degree. The staff consists of a director, twenty lecturers and 25 assistants and clerks. During the session 1912-1913, 190 students were in attendance.

Royal Agricultural Colleges. — Students having been through the middle schools and requiring a higher agricultural education, both practical and theoretical, go to one of the five Royal Colleges at Debreczen, Kassa, Keszthely, Koloszvár and Magyaróvár respectively. These institu-

tions take both full-time students and those who only wish to follow certain lectures. The course lasts three years (6 terms) and during the first year the instruction chiefly takes the form of practical work. The following subjects are taught at the Colleges: natural history, physics, plant production, rural economics, social economics, and practical agriculture including special branches.

Each College has a farm of 640 to 1100 acres attached to it for instruction in the actual practical work. Besides teaching, the staff carries on a certain amount of experimental work and advises on agricultural questions, for which purpose an agricultural consulting committee has been organised in each institution. During the session 1912-1913, 452 full-time and 9 part-time students were in attendance. The capital involved in these institutions amounts to £267 808, while the returns from the farms in 1913 were £3 144 (1).

Training Colleges for Elementary School Teachers. — Two training colleges have been established, one at Kecskemét for men and the other at Komárom for women (2) in connection with the Schools of Practical Agriculture in those places. Students who have taken the college diploma may become teachers in the rural complementary schools and some of the women students take up posts in the schools of domestic economy. The course lasts two years and only those candidates are admitted who already have their teacher's certificate and are under certain age limits, *viz.* twenty-two and twenty-four years old for men and women respectively. Forty students can be taken at Kecskemét and thirty at Komárom; the teaching staff amounts to seven and five lecturers respectively. Instruction is both practical and theoretical, the performance of a certain amount of practical work being compulsory. Women students are given general instruction in domestic economy as well as in agricultural subjects. Excursions are arranged to visit model farms in districts where poultry farming and market gardening are important industries, in order to provide the students with good object lessons in those branches. The students are further called upon to give popular lectures and demonstrations as part of their training.

Schools of Practical Agriculture. — These are the most elementary agricultural schools in Hungary and provide technical instruction to the sons of small farmers and under-managers on large estates. They are under Government administration and their organisation varies with the requirements of the district in which they are situated: for instance those at Ada, Békéscsaba, Hodmezövásárhely, Jászberény, Karczag, Kecskemét and Nagykálló have a six-months course for farmers and small landowners in the general management of holdings, while the schools at Kisszeben, Lugos, Pápa, Rimaszombat, Somogyszentimre, Algyógy, Breznóbánya, Csák, Csikszereda, Komárom, Nagyszentmiklós and Szilágysomlyó have

(1) See also No. 453, B. May 1913.

(2) See No. 402, B. May 1914. (*Ed.*).

a two-year course and give more advanced instruction adapted to the training of farmers, under-managers and inspectors.

In all these schools the instruction is chiefly of a practical nature and much stress is laid on the satisfactory performance of the various kinds of manual work; on the theoretical side, only the most fundamental and indispensable facts are treated, the object being to keep the whole scheme of education at a popular level. Schools which are destined solely for the training of under-managers take pupils of twenty-two years of age, preferably after they have finished their military training; other schools admit pupils of seventeen years old and upwards. At Algyógy there is accommodation for sixty internal students, who do all the practical work in both the fields and the garden.

Short elementary courses, lasting two months, are organised at these schools during the winter for adults who cannot leave their farms for a longer period of time. Besides these, short summer courses lasting four weeks are held for elementary school teachers who wish to qualify as complementary school teachers, and popular lectures are given to the farmers of the district on the use of farm implements and the cultivation of special crops. During the winter the regular students receive instruction in the domestic industries. All teaching is done in the simplest language and illustrated with practical experiment and demonstration; for this reason, special importance is laid on the organisation and equipment of the model farms, which cover altogether an area of 11 700 acres, part of which is State owned while the rest is either let or given rent-free by landowners. The returns on these farms for 1913 amounted to £4873.

The staff of each school consists of a director, an agricultural demonstrator, a gardener and a practical assistant

Besides these State schools there is an Agricultural School belonging to the town of Szabadka staffed by Government teachers. Private Agricultural Schools receiving State grants are also to be found at Csákvár, Bezstercze, Földvár and Medgyes; they are organised on similar lines to the State schools.

Royal Dairy School at Sárvár. — This institution provides suitable training for managers or skilled workmen of milk and cheese factories. Though all students receive both practical and theoretical instruction they are divided into two classes according as they are preparing to become managers or skilled workmen. The former class have to be over twenty years of age and to have already been through a course at a school of practical agriculture; the latter class are admitted at seventeen and only require to be able to read and write; during the session 1912-1913 attendances numbered 4 students of the former class and 17 of the latter. The course lasts one year.

Schools for Dairymen. — There are two of these, at Kisbér and Csák. The course is essentially practical and lasts one year.

The State Lecturers who teach agriculture in the agricultural colleges also act as advisors and organisers in the various districts, write agricultural articles for the local papers, give lectures and

supervise model farms. Besides these twenty-eight lecturers there are two lecturers in secondary boys' schools to help with the general organising and advisory work and four specialists to advise more particularly on the cultivation of potatoes, hops, hemp and flax, and on the improvement of pastures.

A School of Domestic Economy has been created at Putnok for the daughters of farmers, while seven travelling schools each under the control of two teachers give courses lasting six weeks in other parts of the country. They receive State grants amounting to £1666 annually.

During the winter popular agricultural lectures are given, towards which the State makes an annual grant of £4170.

Special schools also exist for the various branches of agriculture, such as poultry keeping, bee keeping, viticulture, horticulture, forestry, etc.

In conclusion the following figures summarise the annual expenditure by the Hungarian Government on agricultural education, which is almost entirely directly dependent on the State.

	Ordinary expenditure	Extraordinary expenditure
	£	£
Royal Veterinary College	21 846	4 417
Agricultural Colleges	48 929	9 792
Lower agricultural education, including advisory and organising work	84 047	22 000
Totals	154 822	36 209

Reclamation in the Province of Ferrara

by

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The agricultural awakening of the Province of Ferrara has been closely connected with the carrying out of the projects of reclamation ; this work was begun under the rule of the Este family, but reached its greatest development in the second half of last century, when, with the help of modern engineering methods, human activity was able to attack and conquer the problems entailed in the definite and permanent reclamation of the marshes and lagoons.

The traces of the work carried out by the organizations formed to deal with these problems as far as the then existing means would allow will never be effaced : the division of the Ferrara territory into four drainage districts still exists, and it may truly be said that the colossal work of mechanical drainage performed on the second and third of these forms one of the most imposing monuments to the civilization of the third Italy.

Out of the 655 000 acres forming the territory of the Province, one may reckon 155 000 as still occupied by bracks used for fishing (115 000 acres) or by rivers, canals, buildings, etc.; the remaining half a million acres represent the raw material of agricultural and forest production. The last-named may be left out of consideration, as the woods occupy hardly as much as 6 500 acres, mostly in the territory of Mesola, — a poor remnant, which, with the classical pinetum of Ravenna, serves to recall the vast forests of holm-oak and pine which in ancient times clothed the further margins of the lagoons of Venice and the Romagna.

The survey of 1835 divided this area of 500 000 acres into 204 020 acres of field crops, 172 080 acres of natural meadows and pastures, and 105 953 acres of reed-beds; the data for the agricultural survey of 1906 show 399 608 acres of crops and 80 015 acres of meadow, leaving some 15 000 acres for woods and vineyards.

These figures give a clear idea of the scope of the reclamation work: the arable area has been *doubled* as a result of draining the marshes and the " meadows and pastures " — a euphemistic way of referring to swamps, nearly or quite unproductive; these have been turned into highly fertile plains on which wheat, hemp, beets and leys extend yearly and give such enormous crops that this land must be considered as among the most productive in the whole of Italy.

At the present time the agricultural land of Ferrara consists of a complex patchwork of newly-reclaimed plots with the ancient holdings and " old lands " under cultivation for centuries. Although the contemporary period of this story contains many unfortunate episodes, so that with the names of the successful men must be mentioned others who have spent their labour and means in vain, yet the impetus to further conquests shows no diminution. There are already 215 000 acres from which the drainage-water is drawn off by 18 pumping-stations, and projects are on foot for two further areas, each of some 20 000 acres: one belonging to the northern levels (" valli ") of Comacchio, and the other in the salt levels of Argenta and Porto Maggiore, which will form the so-called Mantello innings (" bonifica del Mantello ").

In contrast with this land drained mechanically by pumps — that is the typical Ferrarese type of undertaking — should be considered the land in the commune of Bondeno which has a natural outlet, the water flowing off by means of the great canal of Burana or Volano, which passes under the ruver Panaro by means of the famous " Botte Napoleonica ". This vast zone of reclaimed land consists of 26 690 acres in the Province of Ferrara, 54 750 acres in the Province of Modena and 47 060 acres in the Province of Mantua. With the drainage water from this great basin and the possibility of receiving water from the main stream of the Po through the Pilastresi sluices, the old Volano course of the Po has again become a river rather than a canal, and indeed for a considerable distance has a natural fall; it has also become the principal waterway of the Ferrara district, as well as a source of water for agricultural purposes.

The particulars of these reclaimed lands have been given in detail in various publications, to which we would refer readers who wish to study the question more in detail. In this short account it seems best to confine our attention to certain features of a general character.

From the purely technical point of view reference should first be made to the great difference in the problems presented according as the land has been reclaimed from freshwater or from saline marshes (" valli dolci " or " valli salse ").

The low-lying parts of the *freshwater marshes*, prior to drainage, were occupied by a more or less vigorous growth of reeds or other marsh plants. The succession of generations of such rhizomatous plants for centuries has given rise to strata of peat (" cuora "), in some places reaching a sufficient depth to allow of utilization for burning or as raw material for certain industries. But even these marshes rest on a distinctly saline subsoil, as can be seen at once from the nature of the water at some depth. Except for the markedly peaty areas, which require quite special treatment, one may say that these soils present no special obstacles to opening up for cultivation. With systematic treatment they may in a short time be put under highly paying crops. The fact that sufficient care has not always been taken in dividing up these lands is due to difficulties of a different character (to which we shall refer shortly) and not to the physical characters of the soil.

The behaviour of the land obtained by reclaiming *salt areas*, or *bracks*, is totally different, and as the new schemes refer to the inning of land covered by salt water it seems advisable to go more into detail on this point. Anyone familiar with the " Gallare " — typical of innings of this kind — or similar farms, such as what was once the Tassoni brack (reclaimed by Cav. M. Marini), knows that considerable areas may remain refractory to the usual methods of cultivation for several decades after the completion of the engineering works freeing them from water. Soils impregnated with saline matter, such as those inned from the lagoon, require special treatment to deal with the sterility resulting from the accumulation and continual change of level of these salts in the arable layer. We may here mention one or two fundamental points of such treatment not always remembered by the promoters of the reclamation of the bracks : owing to the position of these soils, their physical and chemical composition and their structure, and owing to the enormous quantity of salt contained in the mass, the possibility of profitable cultivation — when the engineering work is finished — is not only dependent on a period of absolute unproductivity, much longer than is generally admitted, but even later is subject to variations which cannot be foreseen and which are due to the special behaviour of the saline matter.

We have already given prominence to these considerations, though fully aware that they cannot outbalance the reasons of a social nature and especially of convenience which have created an opinion decidedly favourable to the carrying out of the reclamation of the stretches of lagoon in question. It would be well that the example of the practical results

furnished by the reclamations already accomplished should not be taken as the only criterion for the opening up and improvement of the neighbouring land, which is not always in a suitable condition for reclamation with a view to agricultural use. The planning, the execution and the completion of the past, present and future reclamations should not be effected entirely to the detriment of the " water farming " (vallicoltura) ; an investigation should be undertaken with a view to establishing once for all the productive capacity of this land under water and the best means of encouraging a reasonable and intensive " farming " of it ; such " farming " requires far less sinking of capital and at the same time lends itself to the natural tendencies of the local inhabitants concerned, so that it might well hold its own in comparison with the arable land to be inned from these inlets of the lagoon.

The fundamental work of reclamation for both freshwater and salt lands consists in drying, that is in the mechanical drawing-off of the ground water. There is not the slightest doubt as to the perfection with which this is now carried out by the engineers, who are thoroughly versed in the setting up of the necessary plant and in the maintenance of the scheme of drainage ; in all the operations so far carried out the removal of the water was obtained in the most perfect and simple manner possible ; though the methodical evacuation of the water is the primary necessity for these tracts lying at such a very low level, it is only one side of the complex problem entailed in opening them up for agricultural use.

This drying is naturally only relative, allowing a certain depth of free soil above the water-table. For this reason the individual characteristics of the different soils, especially as regards water-holding capacity, should be taken into account ; evidently sandy and clay lands cannot have the same treatment. The possibility of cultivating these reclaimed lands properly depends in particular on the reserves of water which the crops find at their disposal, and obviously an excessive drying may be as injurious as a condition of stagnation leading to swamp formation.

The working of the pumping engines is so regulated as to avoid any danger in this direction. In some of the very large sections covering something like 100 000 acres there are considerable differences in level ; in such cases it is now the rule to keep the so-called high-level water separate from the low-level water, the two being dealt with by different pumping stations. As an example of this may be mentioned the system adopted by the Association for the " Grande Bonifica " ; for the completion of this area, carried out between 1905 and 1910, they rearranged the old station at Codigoro to dispose of the high-level water (from an area of 39 929 acres), while the low-level water (from 89 875 acres) runs off by means of a new station put up close to the old one.

Although the drying is carried out in accordance with the needs of the crops, these are subject to the same risks as those on the neighbouring old lands as regards water supply. Indeed seasons in which the yield of these artificially dried soils is seriously reduced by drought are by no means rare.

In fact drought makes itself felt more severely on these soils, as the water is liable to take up mineral matter from the subsoil, constantly impregnated with salt, and may thus become too saline for the ordinary crops. We have elsewhere had occasion to refer to the difficulties attendant upon the excess of saline matter in the water taken up by the arable layer, which may provoke a special condition of " physiological drought " ; the same point has been referred to by Tacke in his masterly advice on the water economy of moor and fen soils : " The drawing-off of the water must be done with great care, as organic soils retain large quantities of water with such tenacity that the roots of the plants growing in them cannot make use of it; in such soils plants may suffer from lack of water in presence of considerable quantities of it.... ; once the stagnant water has been dealt with and the land brought under cultivation, only small amounts of water should be drained off ".

Pure sandy soils require similar treatment, as their productivity depends entirely on the presence of the water-table near enough to the surface to be within reach of the roots. The vineyards of Comacchio and parts of the cultivated land of the Mesola are in a flourishing condition solely because the water conditions have not been disturbed ; they form a marked contrast to certain old sandhills wedged in between low-lying reclaimed zones and consequently subject to excessive drainage: the careful running-off of the rainwater and the lowering of the water-level in the soil have led inevitably to absolute sterility in the higher sandhill tracts. In the modern work of completion of the Grande Bonifica it was recognized that this area would have to be isolated from the remainder and submitted to special treatment suitable for sandy land.

So far no plans have been made for correcting any possible deficiencies in the drainage schemes by means of irrigation. It is certainly very exasperating in some years to have to watch the crops daily drying up owing to continued drought, while up above the Grande Bonifica rises the great bank holding in the water of the Po on its way to the sea ; the Po water is, however, coming to be used for hygienic and agricultural purposes, as the need has become more acute with tl e yearly increase of the permanent population of the reclaimed lands.

It should be recognized that while the removal of the water — the main scope of the *engineering reclamation* — presents great difficulties, the difficulties encountered in the *agricultural reclamation* — that is opening up the land for cultivation and colonization — are equally serious, if not more so. The water from the ditches and main drains, as well as the ordinary well water, is absolutely unfit for watering cattle or for household and agricultural purposes; it is charged with saline and organic matter and becomes putrid in summer. Petitions for a supply of drinking water used frequently to be made by the people of the reclaimed areas and it was owing to the initiative of the Commune of Iolanda di Savoia that the legislation in vigour was altered, so that by the law of June 25 and July 13, 1911, communes in reclamation areas were added to the list of those allowed special facilities for the provision of drinking water. " If our

Commune, planned and founded contemporaneously with the carrying out of the reclamation scheme, cannot boast a past, it may well be proud of its present work " : so said Comm. A. Marangoni, who has been intimately connected with the Grande Bonifica of Ferrara, on the 15th of June, 1913, in opening the communal aqueduct, by means of which Iolanda di Savoia " has no longer fetid and stagnant water spreading fever and death, but pure and healthy water shooting up to many feet above the ground and bringing healthy and vigorous life to these redeemed lands. "

In the vast area of the Grande Bonifica (133 000 acres) provision has been made for obtaining water from the Po by means of four syphons, planned and constructed under the direction of Ing. Pasini. All the farms in the area feel the benefits of this work in completion of the reclamation, as they can provide water for the watering of live stock, for household use and for retting hemp. A logical finishing touch would have been the carrying out of Ing. O. Balduzzi's scheme for a Po valley aqueduct, to provide drinking water to the 103 200 inhabitants of 11 communes lacking it. As this remained in the condition of a project, the Ferrarese Reclamation Society — whose land makes up the greater part of the Commune of Iolanda di Savoia — with its usual enterprise, took up the construction of the communal aqueduct under the provisions of the law mentioned ; the Po water is filtered and purified on the Puech-Chatal system and brought into the area by a steel conduit 18 miles long ; finally it is distributed to the chief farms and groups of houses in the territory of the commune at the rate of 14 000 cu. ft. per day.

The Volano Po, or Burana, which runs from west to east through the province of Ferrara, has also been laid under contribution for water for agricultural purposes. Its value has been increased since the construction of the Pilastresi sluices has allowed water from the main Po to be run into it, but unfortunately the Burana is, and will continue to be, chiefly a drainage canal into which are run the waters from the 3rd, 4th, and 6th sections of the Burana innings : it also receives the water from the hemp-retting and in particular the refuse water from the sugar factories along its course. For these reasons water from it has a very limited use, and one of the associations most concerned is now making plans for obtaining water direct from the Po for the needs of its vast territory.

While the provision of water for agricultural purposes in this 3rd drainage section is difficult and costly, the provision of drinking water is equally so and sometimes not economically possible : we do not here refer to ordinary wells, as with rare exceptions the water they give is scanty and bad. So far the best results have been obtained by deep tubular wells, of which there are a certain number here and there in the Ferrarerse territory. Their depth varies from 80 to 600 ft. ; some only lasted for a very short time, while the use of the water from some others was prohibited for preposterous hygienic reasons about the quality. Special mention should be made of the well bored at the Bastioni farm on the Val Gallare property ; this is nearly 600 ft. deep and for over thirty years has given a constant supply of about 1 ½ gallon per second. Last year this source was covered

in, and after filtration it is now distributed through 12 miles of steel tubing to 40 fountains at the numerous farms round.

Yet another vital problem of the reclaimed zones remains to be mentioned, namely the question of means of communication : there are still large areas inaccessible for several months in the year owing to lack of roads ; the laying of good roads to connect the reclaimed lands with the nearest centres requires a great outlay. Happily the most economic means of transport of agriculturial produce, namely by water, can to some extent be substituted for roads, which in these one-time bracks are yet to come. The chief canals have indeed been arranged so as to be navigable, but access to the wharves or landing-stages must be provided and the farms must be joined up one to another and to the nearest centres. There is no need to go deeply into the question, as the above will suffice to call attention to one of the causes which has contributed and still contributes to retard colonization of the reclaimed areas.

These considerations indicate that it would be very instructive to make an investigation into the real cost of reclaimed land, especially so as to be able to make proper comparisons as to the utility of continuing the inning at the expense of the lagoon. There is a fundamental difference between schemes which have in view the reclamation of land at present more or less completely and constantly submerged under salt water, and such schemes as the great Rhine reclamation, now being carried out, in which it is a question of laying out permanent drainage for vast stretches of land whose productive power is paralized by the lack of a proper outlet for their waters. Probably, however, the calculation of the true total cost of such reclamation can never be made : it would show up the perseverance and strong spirit of initiative possessed by the past generation of farmers, who selected this extreme corner of the Po Valley for their operations. The names of Count Francesco Aventi, Count Luigi Gulinelli and Ing. Gerolamo Chizzolini — to mention only some of those no longer living — will always be remembered as among the numerous band of pioneers who devoted brains and money to carrying through this reclamation work. It should be repeated here that the fundamental work of engineering reclamation was performed on private initiative and with private capital, at a time when the Government seemed almost ignorant of the existence of any such important problems. It was only after the passing of the law of 1882, modified in 1901, that the State took a part in the completion of the work.

It will still be possible to calculate what has been spent by the State and by local bodies in completion of the work, at any rate where such expenditure was undertaken to satisfy collective needs. But the total sum sunk by private persons defies all attempts at estimation, whether it be that expended on the large properties organized on industrial lines or that due to large, medium or small landowners.

Among the large organizations for intensive cultivation or industrialized agriculture, special mention should be made of the Ferrara Land Reclamation Society and its derivatives — the Immobiliare Lodigiana, the Immo-

biliare Veneta and the Amministrazione Mazzotti, besides other smaller ones comprised in the Association for the Grande Bonifica — and of the Val Gallare and Valle Volta Societies, comprised in the 2nd section ; all these have been the subject of numerous publications and serve as object lessons for all engineers and agriculturists. No less worthy of mention are the numerous farms whose present prosperity is the fruit of the labours and faith in the agricultural industry of the much abused class of large and small Ferrarese landowners.

The fertility of the redeemed land, after it has been properly laid out, has often been referred to : yields per acre exceeding 37 bushels for wheat, 16 tons of beets and 12 cwt. of hemp lint are by no means exceptional. There are still a few pieces of land, which as Prof. Munerati wrote some time ago, have not yet been awakened by phosphatic manuring, the foundation-stone of scientific agriculture ; such lands require an enormous expenditure of capital to bring them under cultivation, and they have absorbed and continue to absorb a large part of the returns given by the crops on them.

In the early years of cultivation these lands were robbed by excessive grain-growing : they form another example of the specialized agriculture which is started wherever virgin land is suddenly opened up for farming, as shown by the agricultural history of all countries. But this extensive cultivation had a short life ; these reclaimed lands gradually came to resemble the densely populated old lands surrounding them, as regards the working plan, the arrangement of the farms and the means of production.

The tendency is to form farms of about 75 acres — the old-fashioned " versuro " — which, at any rate in the early stages, are run on the " boarico " (1) contract system. Many private estates have already reached this condition, and modern necessities incline to still further reduction of the holdings, so as to make them suitable for farming on the métayer system or for letting to colonizing families. On the larger estates such division exists only in theory, as the complex circumstances already mentioned prevent its being carried into practice.

We may finish up with a few statistics, which refer to the whole province of Ferrara and not only to the reclaimed areas. The following table

Crop	Average 1862-1871		Average 1909-1913	
	Per acre	Total	Per acre	Total
Wheat . . . . . bushels	16.26	1 875 335	29.13	4 323 935
Hemp . . . . . cwt. .	6.3	294 375	9.0	619 900
Beets . . . . . tons . .	—	—	14.9	226 966

(1) The " boarico " contract is one in which a head ploughman is put in charge of a certain number of teams of oxen; he is housed and receives part money wages and part wages in kind. (*Ed.*)

gives the average yields of certain crops for the decade 1862-71 in comparison with the agricultural statistics for the 5-year period 1909-13.

The cattle numbered 70 000 in the 1869 census and 110 320 in the 1908 census.

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The Swine Raising Industry in Canada

by

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The swine raising industry in Canada is closely allied with what may be termed general agriculture or mixed farming. Even the early settlers raised a few hogs to supply themselves with meat and to provide a product acceptable to the local merchant in exchange for products of commerce. With the development of urban populations and the growth of the lumbering industry, there grew up a demand for pork products. In the case of beef, the butcher very early became a necessary factor, while in the swine industry, the farm continued to combine the breeding and feeding operations with the slaughtering and curing of meat. Then there arose a more or less extensive fresh pork trade, but it was not until the packing houses were established about 1860 that an export trade began.

Of the early years of the industry, Mr. William Davies of Toronto, the pioneer pork packer of Canada, writes :

> Fifty years ago or even more, large numbers of dressed hogs were brought by farmers to Toronto. Besides the few that were bought by local dealers many were bought by commission men in the city for local operators in Montreal. These carcases were chopped up and packed in barrels with a certain amount of salt, then coopered up tight and filled with water and brine. These barrels were then shipped by boat to the consignees in Montreal. In a few instances they were taken down by local Toronto men. Arrived in Montreal these barrels of pork were taken to a Government Inspection Warehouse. The inspectors were sworn Government Officials and they made out a bill for each owner specifying so many barrels of mess pork, so many of prime mess, etc., and armed with this certified bill the products could be sold to Montreal merchants, from whom the stuff found its way into the pineries to feed the lumbermen. At that day there was positively no export trade. Soon

after that a reciprocity treaty with the United States was enacted and as hogs were much more plentiful in the United States than in Canada, and mess pork in barrels was put up in the United States on a very large scele, it came to Canada duty free and thus there was a considerable surplus available for export, especially as the kind of hogs desiderable for the lumbermen's use were "mammoths" while the sort desirable for export were "light weights". From that time the export business increased largely.

While the market for Canadian pork products was confined principally to a home demand, there was no incentive to change from the customs that had become well established, but so soon as there was an appreciable quantity for export, the requirements of the importing country had to be reckoned with.

It was, as it is today, the business of the farmer to raise the hogs, but to find a market depended upon the commercial man, who, in this case, was the pork packer. Fortunately for the industry, which expanded very rapidly, there were in Canada farseeing men engaged in the packing business, and on these the swine raising industry depended more than upon any other agency. They set about developing the right kind of hogs for the best trade.

The English market demanded medium weight hams and "Wiltshire sides" full of lean meat. Experience taught the packers that the Yorkshire and Tamworth breeds excelled in these particulars. To encourage farmers to raise hogs of these breeds, leading packers imported boars and distributed them in hog raising sections. This was done in sections of Ontario about 1890. The result was very pronounced and in the desired direction, for in a few years Canadian hog meats became very popular on the British market.

The possibilities of the bacon industry appealed to Provincial and Dominion Governments perhaps more especially at the beginning. The Ontario Department of Agriculture during several years in the nineties conducted a most effective campaign on behalf of the "bacon" hog. By means of Winter Fairs and Farmer's Institute meetings, Ontario farmers were shown conclusively that the "bacon" hog was the most profitable to raise and the most readily sold in the best markets of the world. The correctness of the teaching in those days is amply borne out by the report of the Swine Commissioner who visited Denmark and found that the Danish pig, from which the highest-priced bacon in England is made, corresponds exactly with the pigs advocated for Canadian farmers and at the present time raised by them in every province. The results of this campaign of education were so pronounced that within a few years the railroads leading to the large packing houses were loading hogs at almost every country station once or oftener weekly with stock that came well up to the standard for the export trade.

Nor were the other provinces asleep in regard to the swine breeding industry, as in each one of them excellent progress has been made, more especially in the matter of quality. In each and every province the "bacon" hog is the Standard and the pigs that win the best awards in the Eastern provinces are of the same general type, age and weight as those that take the best awards in Ontario and in the Western provinces.

The Federal Department of Agriculture has done much to uplift the industry, more especially in the provinces outside of Ontario. Through the Branch of the Live Stock Commissioner the teaching commenced in Ontario has been extended to other parts of the Dominion both at Institute meetings and Winter Fairs, while these latter organizations have been induced to frame their prize lists so as to encourage only breeds of the "bacon" type. The Federal Department of Agriculture, in conjunction with other agencies, has also distributed by means of section sales and through Farmer's Clubs breeding swine of superior quality. Then the Experimental Farms have rendered and continue to render a highly valuable service in experiments carried on more especially at the Central Farm, where the questions of economical feeding and sanitary housing have been very largely solved.

The Export Trade.

From small beginnings in the early nineties, the export bacon trade with Great Britain grew by rapid strides until in 1905 Canada supplied the Mother Country with about 20 per cent of her imported bacon. For a number of years a highly satisfactory export trade was maintained, but since 1907, a decline has been in operation until Canadian supplies to the Old Land have fallen to about one-third what they were when the trade was at its height.

It must be noted that up to about 1884 much of the export pork was made from United States hogs. Soon after that time Canadian hogs were raised in sufficient number to keep the packing houses supplied.

The following table shows the exports of bacon, hams and pork from 1868 to the fall of 1913.

Exports of Bacon from Canada.

Fiscal Year	Bacon	Hams	Pork	Total
	lbs.	lbs.	lbs.	lbs.
1868	—	10 580 528	3 506 048	14 086 576
1870	—	19 627 216	6 544 384	26 171 600
1880	8 616 739	955 603	1 281 391	10 853 733
1885	7 189 260	962 827	555 436	8 707 523
1890	7 235 336	256 746	233 899	7 725 981
1895	37 526 058	2 607 968	519 736	40 653 762
1900	132 175 688	2 856 186	1 109 550	136 141 424
1905	116 835 050	2 866 263	2 235 936	121 937 249
1908	92 001 910	3 173 950	769 932	95 945 792
1909	70 564 927	3 271 312	335 343	74 171 582
1910	45 576 883	3 242 806	599 081	49 418 770
1911	56 068 607	3 805 918	417 577	60 921 102
1912	59 979 963	3 124 595	434 480	63 539 038
1913	36 212 190	2 476 654	521 533	39 210 377
1913*	15 522 804	1 144 707	370 993	17 038 504

* April-October.

The falling off in exports does not indicate a serious decline in the raising of hogs. According to the Census of 1891 there were that year on Canadian farms 1 733 850 hogs, which number had increased ten years later to 2 353 828, and in 1911 to 3 610 428.

Federal meat inspection in Canada, which is confined to establishments doing an export or inter-provincial trade, was inaugurated in September, 1907. The following table shows the number of hogs slaughtered in inspected establishments in Canada year by year since that time :

Swine Slaughtered in Canada at Inspected Establishments (1).

	Number
8 months ending March 31, 1908	861 989
Year ending March 31, 1909	1 532 796
» » » 1910	1 261 496
» » » 1911	1 452 237
» » » 1912	1 852 997
» » » 1913	1 607 741
10 Months ending January 31 1914	1 456 615

The decline in exports must, in large measure, be attributed to increasing consumption in Canada. During the years of heavy export the supplies shipped out were produced almost entirely in the Province of Ontario. The western provinces, while filling with people, were slow to produce hogs until the past two or three years, when a great increase in production has taken place. Up to 1913 packing houses in Ontario and Quebec had a large market west of the great lakes, but the tide has turned. Prairie province farmers, owing to continued high prices for pork, have turned their attention more and more to the feeding of hogs on their low grade and damaged grain, and since the fall of 1913 have been shipping hogs east in large numbers. During 1913 the slaughtering of hogs in Canada showed a very slight increase over that for 1912. The killings in eastern houses showed a decrease which was slightly more than met by an increase in the west. This is borne out by statistics supplied by the Meat Inspection Division of the Department of Agriculture in the following table.

Hogs Slaughtered in Inspected Houses.

	1913	1912	Increase or Decrease
Eastern Canada	923 908	1 058 486	— 134 578
Western Canada	336 147	145 064	+ 191 083

The exports of hog products from Canada have, until quite recently, been almost entirely to Great Britain. With the coming into force of the "Wilson-Underwood" Tariff in September, 1913, the markets of the United

(1) A large number of swine are slaughtered in Canada in places other than those under federal inspection.

States of America were thrown open to meat products on a free basis. Since that time increasing quantities of Canadian bacon, hams and pork have been finding their way over this international boundary.

Pedigree Registration.

The registration of swine in Canada commenced with the Berkshire breed in 1875, but it was not until 1882 that other breeds commenced to be recorded. That year, a record was opened for Suffolks, Yorkshires and Tamworths, and at various periods up to 1892 practically all of the present breeds in Canada, with the exception of the Hampshires, were being recorded ; Hampshire records were opened in 1910. The work of registration was carried on by the Agriculture and Arts Association of Ontario until about the year 1900, when that body ceased to exist. From that time until the National Live Stock Records were formed in 1905 (under the Live Stock Pedigree Act of 1901) the work of registration was done by the late Henry Wade, Secretary of Live Stock Associations in Ontario.

Since 1905 the registration of swine in Canada has been carried on under the National Live Stock Records System at Ottawa.

The development of a Canadian " bacon " hog is strikingly reflected in pedigree registration. During the past thirteen years hogs of breeds of the " bacon " type have increased by leaps and bounds, those approaching that form have more than held their own, while certain breeds of the short, thick type have passed off the stage so far as registration in Canada is concerned. The following table shows the number of pedigrees of each of the several breeds that have been recorded up to 1900, the number of each recorded up to the beginning of 1914 and the number of each recorded since the beginning of the present century:

Pedigree registrations :

	Up to 1900	Up to 1914	No. since 1900
Berkshire	12 147	29 350	17 203
Yorkshire	6 681	46 393	39 712
Tamworth	2 398	10 063	7 665
Chester White	2 519	11 420	8 901
Duroc Jersey	706	2 363	1 657
Poland China	2 595	3 878	1 283
Hampshire	—	933	933
Essex	20	272	252
Suffolk	262	281	19
Victoria	14	—	—

Pure Bred Swine in Canada.

The following table compiled from Canadian Census returns of 1911 shows the numbers of pure bred swine in Canada, by provinces, in June of that year:

Breeds	Alberta	British Columbia	Manitoba	New Brunswick	Nova Scotia	Ontario	Prince Edward Island	Quebec	Saskatchewan	Canada
Berkshire	1 771	342	1 995	235	187	7 455	246	740	918	13 889
Chester White	23	39	62	301	52	1 665	112	1 901	42	4 197
Duroc Jersey	214	2	33	—	12	436	1	22	10	730
Essex	—	15	—	—	—	31	—	—	—	46
Hampshire	2	70	20	1	—	664	4	153	2	916
Poland China	215	5	145	—	4	388	—	120	93	970
Suffolk	—	—	2	—	—	4	—	5	—	11
Tamworth	141	53	363	41	—	2 996	1	634	64	4 293
Yorkshire	2 120	386	2 385	775	353	15 459	603	4 013	1 635	27 729
Not specified	108	255	532	112	33	1 755	42	696	113	3 666
Total	4 594	1 167	5 537	1 465	661	30 853	1 099	8 284	2 877	56 447

SECOND PART.

ABSTRACTS

AGRICULTURAL INTELLIGENCE

GENERAL INFORMATION.

AGRICULTURAL EDUCATION

806 – **Courses of Instruction for Teachers in Rural Continuation Schools in Prussia.** — *Zeitschrift für das ländliche Fortbildungsschulwesen in Preussen*, Year 5, Part 9, pp. 397-398. Berlin, June 1914.

Special courses were to be held this year in 19 places in Prussia for the instrction of teachers in rural continuation schools.

ORGANIZATION OF EXPERIMENTAL AND ANALYTICAL WORK

807 – **Recent Experience in Farming on Moors.** — *Communication from* DR. HJ. VON FEILITZEN, *Director of the Experimcnt Station of the Swedish Moor Cultivation Association.*

Among the recent works which deal with the nature of humic substances those of BAUMANN and GULLY, TACKE and SÜCHTING, RINDELL, ODEN, SCHREINER (1), and SHOREY deserve to be mentioned, and on the chemistry of the nitrogen of moor soils the works of JODIDI, SUZUKI and VALMARI.

The formation of limonite and its explanation by AD. MAYER and RINDELL led to a closer discussion of HAGLUND'S so-called fire theory and to the explanation of the origin of sphagnum moors through the destruction of the moor forests by fire (2).

On the growth of peat, recent investigations in Sweden have shown that in a moor 36 inches of peat have been formed since 1540. J. AF ZELLÉN measured in one locality a yearly increase of 1 inch of light sphagnum peat. According to TOLF this increase of peat on the surface of diggings has no practical importance.

Concerning the chemical composition of various kinds of peat the following works may be mentioned: ZAILER and WILK on pure sedge peat; GULLY on species of sphagnum and sphagnum peat; PAUL on the

(1) See No. 343, *B.* April 1913; also No. 311, *B.* April 1914.
(2) See No. 312, *B.* April 1914. (*Ed.*).

calciphobe nature of sphagnum; and MINSSEN on the various kinds of peat.

The writer's own investigations have shown that the moor water in untouched moors contains nearly one part of potash per 100 000.

As regards the microbiological properties of moor soils, KARSTEN at Helsingfors has recently made experiments on the low power of conducting heat of moor soils in a dry and moist state. Interesting also are the minimum temperature readings which have been taken during the last five years at Flahult 4 inches above the surface of the soil on different spots near each other, over sandy soils, fens, and cultivated and uncultivated moors, in the months from May to October. They show what considerable differences of temperature different irradiation of the soil causes in places quite close to each other.

Of great practical importance is the question of the draining of moor land. On the moor at Flahult shallow drainage with ditches 2 feet deep and 66 ft. apart, during five years, gave an average yield of hay 25 per cent. higher than that obtained from land drained by ditches 4 ft. deep. With shallow drainage the water-table stood, during the period of vegetation (May to October), at an average of 22 inches below the surface of the middle of the land between the ditches, while with the deeper drainage it stood at 26 inches. The fluctuations of the water-table were in general greater with shallow than with deep drainage.

In experiments made in concrete basins in the experiment garden, with constant heights of water-table (8, 16, 24, 32 and 44 inches), the grass crop in the first two years on sphagnum moor soil was highest when the water-table stood at 8 and 16 in. and decreased rapidly with the lowering of the water-table. On the fen land the crop was heaviest with the water-table at 16 and 24 inches.

In the second experiment farm at Torestorp, experiments have been in course for the last five years on the effect of varying distances (26, 40, 66 and 80 feet) between drains at equal depths (4 ft.). Hitherto no noticeable difference in the vegetation has been observed. The water-table stood everywhere about 36 inches below the surface. In this direction observations have recently been made also in Norway (Maeresmyren), Bavaria (Bernau) and Esthonia (Thoma).

On the importance of damming up the water in the ditches on moors American farmers in Michigan have collected evidence, and the Bremen Station recommends the practice in moor drains. Count BERG, at Sagnitz (Livonia), on the contrary, does not approve of it and recommends instead the use of heavy rollers to prevent the excessive drying of the surface of moor soil which has been rendered too loose by deep tillage.

The percolation of rainwater through well decomposed fen was found in lysimeter experiments at Jönköping to be 90 per cent. on bare soil in the winter half-year, and from 50 to 60 per cent on soil under vegetation. The corresponding figures were 40 and 10 to 30 per cent during the summer half-year.

For many years past a system of drainage has been practised in Sweden much resembling Butz' wooden pipe drainage (1); this latter system also has been used at Flahult with satisfactory results.

Experiments have been made during five years with lysimeters at Jönköping on the quantities of plant food carried away from moor soils by drainage water ; they have shown that the losses on good fen land are much greater in uncultivated than in cultivated soil, and in arable soil than under meadows. More lime and nitrogen are lost by unmanured than by manured soils. In the case of potash the losses were about the same; only traces of phosphoric acid were found. The losses of potash caused by manuring amounted to from 2.23 lbs. to a maximum of 12.49 lbs. per acre per annum. The losses of lime reached 256 lbs. on arable land and 164 lbs. on meadows. A normal dressing of potash salts (38 per cent.) showed no increase of lime washed out over land without potash ; this agrees with the Bromberg results.

The question of liming moors has been very exhaustively treated by DENSCH (2) at Bremen and by SJOLLEMA and HUDIG (3). Dr. NILSSON-EHLE, of the Swedish Seed-breeding Station at Svalöf, has demonstrated that dry-spot disease (*Scolecotrichum*) (4) attacks the various kinds of oats with different intensity and that greater or less resistance is hereditary; of the varieties tested Improved Roslag and Mesdag were the most resistant, while Tartar Flag and Improved Dala were very susceptible. According to Dr. HEDLUND, *Scolecotrichum* does not attack oats, and probably a saprophytic *Cladosporium* has been mistaken for it. The dry-spot disease, or " Kalimangelkrankheit " (disease due to lack of potash) as Dr. Hedlund calls it, is probably caused by soil bacteria, as the plants are not attacked by it when the soil has been sterilized, for instance with carbon disulphide.

That lime must be finely powdered in order to produce the best effects, has again been shown by recent experiments at Jönköping with powdered lime of several sizes of grain, in the course of which experiments the finest powder (passing through a sieve of less than 0.2 millimetre mesh) gave the heaviest yields (5).

Silicate of lime in Martin's slag proved almost equal to the carbonate.

Among new implements for use on moors (6), the most important are heavy cement rollers (7), motor ploughs, Banke's new Swedish meadow plough, Wassis and Hankmo Finnish harrows, the moor ploughs built by the Norrahammer factory and Faxe's moor shoes for horses.

Concerning manures it has been observed at Flahult that farmyard manure has a very feeble action during the first years of cultivation on

(1) See No. 229, *B.* March 1913 and No. 1324, *B.* Dec. 1913.
(2) See No. 1243, *B.* Nov. 1913.
(3) See No. 345, *B.* April 1913.
(4) See No. 575, *B.* June 1914.
(5) See also No. 17, *B.* Jan. 1914.
(6) See also No. 760, *B.* Aug. 1914.
(7) See No. 1067, *B.* Sept. 1913. (*Ed.*).

moor soils; after some years its effect was decidedly better, but much inferior to that of artificials. On the peat soils of a better class the effect of farmyard manure was more marked. A shallow ploughing in to a depth of two to four inches was better than to a depth of six inches. It was found that for turnips it was better to apply farmyard manure in spring than in autumn. The spreading of road sweepings is recommended by SCHREIBER, and in Ontario, Canada, very good results appear to have been obtained by a cartload of garden earth to the acre. Green manuring with blue lupins gave very good results at Flahult; the residual effect was, however, very slight.

Among the bacterial cultures on the market, Azotogen and Kühn's Nitragin in earth cultures have been beneficial on moor soils; on the contrary liquid Nitragin proved uncertain. Earp-Thomas' Farmogerm (from Bloomfield, N. Y.) had very little effect on yellow lupins. Inoculation earth had a good and certain action.

The question of the effect of Leguminosae on Gramineae in mixed crops has been especially studied by TACKE, HILTNER, KASERER, LIPMAN, LYON, and BIZZELL.

The investigations of BOTTOMLEY on *Myrica Gale* deserve to be mentioned here.

HAGLUND, at the Jönköping Moor Experiment Station, tested the effects of artificials and lime on sphagnum and found that lime destroyed it; basic slag acted like lime but less energetically. Superphosphate kills sphagnum. Kainit was somewhat caustic, but without any special effect, and nitrate of soda also acted weakly. The two latter, however, had an indirect action, as they encouraged growth of algae and lichens and thus hindered the formation of new shoots of sphagnum.

It is generally admitted that sedges dislike manuring, because the manuring of meadows causes them to disappear; this is, however, not the case and the apparent destruction of sedges is only due to their being smothered by the other plants. GÈZE, at Villefranche-de-Rouergue (Aveyron, France), has shown by direct manuring experiments, that sedges growing alone respond readily to phosphoric acid, nitrogen and potash.

At the Jönköping Moor Experiment Station experiments have been made for several years on the crops raised on the moors and on the quantities of plant food removed by them from the various moor soils; two years ago the results were published in a voluminous report. There are some deviations from WOLFF's figures respecting certain plants, but in the main the values agree well with the revised figures given by STUTZER in *Mentzel & von Lengerkes landw. Kalender*. The writer's investigations did not allow him to confirm the high figures found by WAGNER and TACKE for the amount of phosphoric acid contained in hay; the figures found by CHRISTENSEN in Denmark, LENDE NJAS in Norway, and KRÜGER and STUTZER in Germany, agree with those of the writer.

Among the different phosphates Palmaer phosphate proved equal to superphosphate. Basic slag was tested in two series of experiments,

and its total effect, lasting three or four years, turned out clearly superior to that of superphosphate. In the Danish field experiments superphosphate and basic slag proved of equal value on field crops, but on meadows the former was somewhat superior. The after effects of basic slag were better than those of superphosphate. In moist years basic slag acted better than in dry ones. Bone meal behaved almost as well as superphosphate on acid moor soils, but badly on alkaline soils. Tunis phosphates, on newly cultivated moor land at Flahult, in two years of experiment, gave only one half the effect of basic slag. Vivianite proved almost as good as basic slag.

As for potash manures, the effect of phonolite (1) was only half that of Stassfurt salts.

Among recent experiments those with "Elektrokali" (2) and Jungner's carbonate of potash, as well as those on the substitution of potash by soda, and the works of WHEELER, SCHULTZE, WOHLTMANN and SÖDERBAUM on the effects of common salt deserve to be mentioned.

CROPS AND CULTIVATION.

AGRICULTURAL METEOROLOGY

808 – **An Improved CO_2 Psychrometer.** — SHAW, H. B. (Bureau of Plant Industry, U. S. Dep. of Agr.) in *The Plant World*, Vol. XVII, No. 6, pp. 183-185. Baltimore, Md., June 1914.

A psychrometer (*i. e.* an instrument used by the U. S. Weather Bureau for measuring the relative humidity in given localities) is described which is designed for use amongst foliage and differs from other psychrometers in being provided with a protecting device preventing entanglement with the foliage while the thermometers are being whirled.

SOIL PHYSICS, CHEMISTRY AND MICROBIOLOGY

809 – **Distribution of Soil Particles.** — BEDFORD, DUKE OF, and PICKERING, S. U., in *Fourteenth Report of the Woburn Experimental Fruit Farm*. London, 1914.

The distribution of the clay particles in a soil was determined in a series of experiments, carried out during a period of 14 months, in order to estimate the influence of the rainfall on such distribution. From a plot of ground 4 yards square which had received moderate dressings of artificial manures for the last 18 years, samples were drawn once a month in three layers of 6 in. each down to a depth of 18 in. The samples were air-dried, sifted, and dried at 100° C.; then 40 gms. were shaken up with 400 cc. of water for 24 hours; after being allowed to settle, 200 cc. of the solution were syphoned off and its clay content was estimated. The results obtained for the top 6 in. of soil are given below, together with the rainfall for the 20-day period preceding each sampling:

(1) See Prof. LEMMERMANN'S article, in *B.* Oct. 1913, pp. 1486-1489; also No. 253, *B.* March 1913 and No. 500, *B.* June 1914.

(2) See No. 420, *B.* May 1914. (*Ed.*).

Month	Clay in uppermost 6 in. of soil		Rainfall during previous 20 days. in.
	per cent of soil. "Absolute"	per cent of total clay throughout the 18 in. of soil. "Relative"	
July 1911.	0.52	23	1.35
Aug.	0.31	9	0.48
Sept.	0.26	11	1.21
Oct.	0.38	21	1.36
Nov.	0.50	24	2.08
Dec.	0.47	18	1.49
Jan. 1912	0.44	24	2.01
Feb.	0.56	29	1.70
March.	0.52	17	1.35
April	0.31	16	0.68
May	0.20	13	0.27
June	0.40	20	2.33
July	0.25	8	1.11
Aug.	0.46	18	2.65

The fluctuations in the "relative" clay content of the top layer of soil follow closely those of the rainfall except during the month of February when the land is in an abnormally wet condition owing to the accumulation of the winter rainfall. If the "relative" proportion of clay in the top 6 in. of soil be calculated on the two topmost layers alone, instead of on the whole depth of 18 in., then the figures, though following the rainfall fairly well, do not do so as well as when the proportion of clay in the topmost 6 in. of soil is considered in relation to the three layers; and from this it would appear that the effect of the rain on the clay particles extends below the top 12 in.

The total "absolute" amount of clay in the 18 in. is by no means constant; this would indicate that the alteration in the proportion of the clay in the uppermost layer is not due to differences of distribution, but rather to deflocculation and flocculation caused by the rain ; on the other hand, as the "absolute" amounts of clay in the top layer do not follow the fluctuation of the rainfall as closely as the "relative" amounts, it would seem that though the flocculation and deflocculation are perhaps the most important effects of the rainfall, they are not the sole ones, and that some redistribution of the particles also occurs.

810 – **The Number and Growth of Protozoa in Soil.** — SHERMAN, J. M. (University of Wisconsin), in *Centralblatt für Bakteriologie, etc. II Abt,*. Vol. 41, No. 18/23. pp. 625-630. Jena, July 22, 1914.

Sixteen soils from Wisconsin, Virginia and Tennessee were examined for protozoa by the dilution method, soil extract being used as the growing medium. It appeared from the results that all the soils contained at least

1000 protozoa per gram and that most probably even 10 000 per gram would still be a conservative estimate. Nearly all the organisms found were flagellates, but *Colpoda cucullus* and *C. steinii* occurred in two of the $^1/_{1000}$ dilutions and *Balantiophorus elongatus* in one of them. No amoebae were found.

Sterilized soils were also inoculated with normal soil, proving good culture media even with a somewhat subnormal moisture content. After 15 days flagellates had multiplied in some cases to the extent of 100 000 per gram of sterilized soil ; ciliates on the other hand made no growth.

811 – **Relation of Bacterial Transformations of Soil Nitrogen to Nutrition of Citrus Plants.** — KELLERMAN, K. F., and WRIGHT, R. C. (Bureau of Plant Industry, U. S. Dep. of Agr.) in *Journal of Agricultural Research*, Vol. II, No. 2, pp. 101-113. Washington, D. C., May 1914.

The writers analysed the soils of certain citrus groves suffering from chlorosis in California and carried out greenhouse experiments in Washington, D. C., from which they obtained evidence that the falling off in yield of the citrus groves may be due to the toxic effects of superabundant nitrates.

OPENING UP LAND FOR CULTIVATION

812 – **Improvement of Waste Land in the Netherlands.** — MÜLLER, A., in *Deutsche Landwirtschaftliche Presse*, Year XXXI, No. 57, pp. 701-702. Berlin, July 1914.

1. *Generalities.* — In the Netherlands the improvement of waste lands commenced in the first few decades of last century with the afforestation of heaths by individual landlords ; some of these now form groups of fine closed woods. The growing interest in the improvement of unproductive lands led the parties concerned to the foundation of the Heath Improvement Society in 1888. At first the State limited its action to the encouragement of private undertakings and to the fixation of certain shifting dunes which were a menace to the community. It was only in 1899, after the institution of a special Forest Service, that the State began to purchase large extents of waste land and to put them under cultivation. It dealt chiefly with lands the improvement of which was important for the neighbouring cultivated areas but not suitable for private enterprise. At present the State Forest Service possesses 46400 acres of waste land and 12850 acres of cultivated land against 26 000 and 6600 in the year 1899. Further, the State assists the Communes in their work of improvement of waste lands by granting loans free of interest and by the technical direction of the work ; the Heath Improvement Society also receives yearly State grants for the promotion of drainage schemes and for holding public courses in forestry.

2. *Treatment of heaths.* — *a) For permanent agricultural utilization.* — The first operation generally consists in working with a steam plough to a depth of 6 to 12 inches ; occasionally in uneven soils the spade is used. Then follows manuring, for instance with 6 to 8 cwt. per acre of basic slag and kainit, and yellow lupins and serradella are sown for a year or two. According to position and soil, oats and rye or potatoes and even beets or peas are then grown. If the heath is suitable for meadow or pasture

the ploughing is only 6 or 8 inches deep and is followed by harrowing. After due drainage and levelling of the inequalities of the surface the soil is manured ; moor soils are frequently covered with a layer of sand 2 to 4 inches deep ; grass and clover are then sown, often under oats or rye, but sometimes after potatoes.

b) *For reafforestation.* — The areas suitable for forests are ploughed to a depth of about 16 inches, and where necessary drained by open ditches and manured with artificials and green manure crops (yellow lupins). They are then mostly put under rye for one or two years (sometimes serradella is taken with it) or, on low-lying land, under oats. After this preparation one-year-old pines are planted at distances of 24 to 30 inches each way. If the locality is suitable, oak, elm, alder and other trees are also planted in clumps or as borders.

3. *Fixation of shifting sands.* — While the heaths occupy about a million acres, the sands cover only about 125 000 acres. About seven-tenths of these are maritime dunes. Considering the importance of this area for agriculture, the State has taken possessions of four-tenths of the coast dunes and three-tenths of the inland ones. In the districts of Haarlem and the Hague some large dune areas have been afforested by private owners.

a) *Inland shifting sands.* — After roughly levelling the greatest inequalities of the surface of the sandhills the ground is partially or wholly ploughed to a depth of 12 to 20 inches. Then the soil is covered with cut heath, marram grass, peat or the like, on which a shovelful of sand is thrown at every step. Recently the areas to be afforested have been treated with various fertilizers, as well as with lupins, the straw of which has proved very useful for covering the soil. Two-year-old pines are then planted by means of iron planting-spades provided with a long and heavy blade which ensures the long pine roots reaching to the moist subsoil.

b) *Dunes.* — For fixing the dunes the Dutch use chiefly marram grass (*Ammophila arenaria*) ; plants preferably one or two years old are carefully dug out and planted in clumps at distances of 20 in. × 20 in. (on slopes 12 in. × 12 in.). As soon as the condition of the soil allows it, Austrian, Corsican and mountain pine are planted. In sheltered spots Scots pine is used with success, as well as pitch pine (*Pinus rigida*) and in some moist places oaks and alders. Where conditions are favourable the possibility of agricultural work is not neglected. Thus, for instance, on the island of Texel, where for a long time sheep breeding has been practised on a large scale (about 30 000 lambs are exported every year), the most sheltered dunes have been devoted to grazing purposes.

813 – **A New Way of Utilizing the Energy of Peat Beds.** — ZAILER, V. in *Zeitschrift für Moorkultur und Torfverwertung*, Year XII, Part 3, pp. 89-91. Vienna, 1914.

In order to utilise the quantities of energy latent in peat beds, the construction of large central electric stations has been undertaken. These works burn only dried peat. This is done in two different ways : the peat is either burnt directly in the fire-box of steam boilers and the steam is used to drive turbine dynamos, or it is burnt in gas generators and the gas used

in motors which transform the energy into electricity. Some of these generators obtain sulphate of ammonia as a by-product.

Of late another method has been adopted, to a certain extent combining the advantages of the two systems, and giving a still better utilisation of the energy contained in the fuel. This is the flameless surface combustion of generator gas under steam boilers. The process was invented at the same time in England and in Germany. It consists in leading a mixture of gas and air under low pressure through a certain mass of fuel which melts only at an exceedingly high temperature. In the interior of the mass an incandescent nucleus is formed which irradiates heat without forming flames. In England some boilers fired with this system have worked uninterruptedly for upwards of nine months, using water gas or coke gas. Any other similar gas can be used equally well. Whilst formerly it was considered satisfactory to produce 8 to 9 lbs. of steam from 1 sq. ft. of heating surface, with this method as much as 21.5 lbs. of steam can be produced from the same surface.

From the point of view of the exploitation of moors it is of great importance that no other fuel need be brought to heat the boilers.

The writer is of opinion that if this invention fulfils its promises a great step will have been made towards the solution of the problem of utilizing the energy latent in peat beds.

MANURES AND MANURING

814 – **Influence of Lime on Soil Bacteria**. — MILLER, F., in *Zeitschrift für Gärungsphysiolo ie*, Vol. IV, Part 3, pp. 194-206. Berlin, April 1914.

The writer contributes to the discussion of the question already examined in various quarters as to the influence of the compounds of lime upon the multiplication and the vital activity of soil bacteria. In the experiments the rather heavy soil of the experiment field of the Agricultural and Bacteriological Institute of the University of Göttingen was used. The soil was taken from the field when it was damp ; it was then sifted and thoroughly mixed. The additions were calculated on the dry earth. The quicklime was added in a finely pulverized state and well mixed with the soil. It contained only 4.16 per cent. of CO_2. The soil under examination contained 2.02 per cent. of CaO and 1.19 per cent. of CO_2. An addition of 5 per cent. CaO made the soil noticeably warmer and additions of 1 and 5 per cent. increased the loss of water from the soil. The experiments led to the following principal results :

1. Additions of 0.3, 0.5 and 1 per cent. CaO caused at first a striking decrease in the numbers of bacteria and later an immense increase. The greater the addition of lime the longer the duration of the decrease, but also all the more intense the increase when it finally set in.

2. The addition of 5 per cent. CaO hindered completely the growth of bacteria.

3. Quicklime in doses of more than 0.05 per cent. on loam rich in lime caused a reduction of nitrification. Doses of 0.01-0.06 per cent. in Bunter sandstone poor in lime have a stimulating effect in this direction.

4. Additions of quicklime up to 0.1 per cent. on sandy soils rich or

poor in lime diminished the formation of nitrate from ammonium sulphate, and doses of 0.5 per cent. CaO stopped this process altogether.

815 – **Experiments on the Value of Nitrate of Guanidin and Nitrate of Urea in comparison with Nitrate of Soda and Nitrate of Ammonia.** — WAGNER, P., in *Mitteilungen der Deutschen Landwirtschafts-Gesellschaft*, Year XXIX, Part 29, pp. 417-421. Berlin, July 18, 1914.

At the request of the German Agricultural Society's Committee on Manures the writer has tested the manurial value of nitrate of guanidin and of nitrate of urea, two new products derived from calcium cyanamide, which it is hoped can be placed upon the market at suitable prices. Samples of the two salts, the former containing 40.20 per cent. and the latter 30.54 per cent. of nitrogen, were obtained by the writer from the " Oesterreichischer Verein für chemische und metallurgische Produktion" of Aussig on the Elbe. The experiments were made on oats and French ryegrass.

1. *Experiments on oats.* — Fifty-two pots were used, each of them containing 46 lbs. of sandy soil of the following composition :

	per cent		per cent
Silt and clay	20.6	Carbonate of lime	0.02
Fine sand	19.4	Phosphoric acid	0.148
Coarse sand	50.1	Potash	0.076
Gravel	9.9	Nitrogen	0.079

TABLE I

No.	Manure	Dates of manuring			Total grams of nitrogen
		April 17, grams of nitrogen mixed with soil on sowing	May 21, grams of nitrogen dissolved in 1 litre of water and poured on soil	May 28, grams of nitrogen dissolved in 1 litre of water and poured on soil	
1	—	—	—	—	—
2	Nitrate of Guanidin	1.0	—	—	1.0
3		1.0	—	—	1.0
4		1.0	—	—	1.0
5	Nitrate of Urea	1.0	—	—	1.0
6		1.0	0.5	—	1.5
7		1.0	0.5	0.5	2.0
8	Nitrate of Soda	1.0	—	—	1.0
9		1.0	0.5	—	1.5
10		1.0	0.5	0.5	2.0
11	Nitrate of Ammonia	1.0	—	—	1.0
12		1.0	0.5	—	1.5
13		1.0	0.5	0.5	2.0

The four manures were given in doses of 1.0, 1.5 and 2.0 grams of nitrogen per pot. Each pot also received 5 grams of phosphoric acid under the form of basic slag, and 2 grams of potash as silicate of potash.

Table I gives the scheme of the experiment; Table II shows the results, expressed as average increase in dry matter over the average of the control pots, which was 20.2 gms. of straw and 6.2 gms. of grain.

TABLE II.

Nitrogen given under the form of:	Increase in yield of straw due to manuring with			Increase in yield of grain due to manuring with		
	1 gr N	1.5 gr N	2.0 gr N	1 gr N	1.5 gr N	2.0 gr N
Nitrate of soda . . .	86.9	104.1	113.4	46.3	70.8	76.7
» of ammonia .	85.7	101.9	100.0	42.1	64.7	71.8
» of urea . . .	62.2	81.8	97.1	37.8	54.8	67.2
» of guanidin. .	33.6	—	—	26.8	—	—

Taking the yields obtained with nitrate of soda as 100, the following relative values are found :

	grain	straw
Nitrate of guanidin.	39	58
» urea.	72	82
» ammonia	99	91
» soda.	100	100

2. *Experiments with French ryegrass.* — For these experiments also 52 pots were used. The soil was the same as that for the experiments on oats. As basal manure 5 gms. of phosphoric acid as basic slag and 2 gms. of potash as silicate were mixed with the soil. To these amounts some more potash was added for the second cut and some phosphoric acid and potash for the third cut, so as to keep pace with the development of the plants. Three cuts were made. The manures under comparison were given as in the preceding experiment, but only to the two first cuts, the third getting no nitrogen.

The injurious effect of nitrate of guanidin observed in the experiment with oats was not noticeable in these tests. The sum of the average increases given by the three series (2,3 and 4 gms.), expressed as dry matter in the three cuts, was as follows (control 18.3 gms.) ;

	gms
Nitrate of guanidin.	312.0
» urea.	350.9
» soda.	358.8
» ammonia.	365.1

If the increase obtained with nitrate of soda be taken as 100, the following relative values are obtained :

Nitrate of guanidin.	87
» urea.	98
» soda	100
» ammonia	102

The writer concludes from these experiments that nitrate of urea can be recommended to farmers as a useful manure, provided the nitrogen in it is sold at about 20 per cent. cheaper than the nitrogen in nitrate of soda. It does not seem advisable to produce nitrate of guanidin as a commercial nitrogenous manure, as its effect was inferior to that of the other three nitrates and in the experiments with oats it was observed that this nitrogen compound was not favourable to plant growth.

816 – **The Relation of Atmospheric Evaporating Power to Soil Moisture Content at Permanent Wilting in Plants.** — SHIVE, J. W, and LIVINGSTONE, B. E. (Botanical contribution from the John Hopkins University, No 37) in *The Plant World*, Vol. XVII, No. 4, pp. 81-121. Baltimore, Md., April 1914.

In their investigations on the point of permanent wilting in plants, BRIGGS and SHANTZ (1) showed that the moisture content of soils where this point had been reached was the same when the experiments were carried out in a damp chamber or in an unshaded green-house. CALDWELL, on the other hand, only obtained moisture residues similar to those calculated from the Briggs and Shantz formula when he grew his plants in a moist chamber. The present investigations were undertaken to determine the effect of the evaporative power of the atmosphere on the soil moisture content at the permanent wilting point. To this end plants were tested under five different conditions of atmospheric humidity : *a*) in the open air, exposure I ; *b*) in a cheese-cloth shelter, exposure II ; *c*) in a lath shelter made of laths 3 cm. wide with 3 cm. spaces between the laths, exposure III ; *d*) in a cheese-cloth shelter placed inside the lath shelter, exposure IV ; and *e*) in a glass chamber protected from direct sunlight and kept saturated by wet cloths, exposure V. The evaporation rate in each exposure was determined by means of a porous cup atmometer. The experiments were carried out at the Desert Laboratory of the Carnegie Institute, at Tucson, Arizona, in July-September 1913. Maize, *Phaseolus vulgaris* and *Capsicum annuum* were used as test plants ; the soils employed consisted of a mixture 25 or of 50 per cent. of a local clay loam with a coarse river sand, or of the clay loam used alone.

The results are summarised in the table on the next page.

These results confirm those of Caldwell in that the higher the rate of evaporation, the higher the water content of the soil at the wilting point. Where the soil employed consisted of a mixture of sand and loam the values actually obtained for soil moisture were all higher than those calculated from the Briggs and Shantz formula, but where the pure loam

(1) See No. 20, *B.* Jan. 1914. (*Ed.*).

Test Plant	Exposure	Evaporation from atmometer cc. p. hour.	Soil used	Water content of soil at the permanent wilting point		
				actual	calculated from Briggs and Shantz formula	ratio: actual / calculated
Maize	V	0.3	25 % loam	4.30	3.80	1.13
	IV	1.5	75 % sand	5.48	»	1.44
	III	2.4		5.78	»	1.52
	II	3.0		6.04	»	1.58
	I	3.7		6.16	»	1.63
Phaseolus	V	0.2		4.70	»	1.25
	IV	2.3		5.36	»	–1.41
	II	3.0		6.22	»	1.63
	III	3.6		5.73	»	1.51
	I	4.8		6.35	»	1.67
Capsicum	V	0.5		5.13	»	1.35
	IV	2.2		5.41	»	1.42
	III	3.2		5.85	»	1.54
	II	3.9		6.59	»	1.73
	I	6.1		7.17	»	1.88
Phaseolus	V	0.2	50 % loam	5.90	5.92	1.00
	IV	2.0	50 % sand	7.85	»	1.23
	III	3.3		8.16	»	1.37
	II	4.5		8.27	»	1.39
	I	5.8		8.37	»	1.41
Maize	V	0.1	100 % loam	10.99	12.52	0.88
	IV	0.6		11.89	—	0.95
	III	1.8		12.03	—	0.96
	II	2.6		12.95	—	1.04
	I	3.9		13.13	—	1.05

was employed the ratio actual: calculated started well below unity and only rose with increasing evaporation to a maximum of 1.05.

The writers discuss the interpretation of their results by means of a formula.

817 – **The Distribution of Stomata in the Seedlings of Some Gramineae.** — ZAEPFEL, EDGAR, in *Comptes Rendus hebdomadaires des Séances de l'Académie des Sciences*, Vol. 159, No. 2, pp. 205-207. Paris, July 13, 1914.

The writer has observed that in oats (*Avena sativa*) and in wheat (*Triticum vulgare*) the stomata are most numerous at the apex of the cotyledon, less numerous in the subapical belt and absent at the base of the cotyledon, while in *Panicum altissimum* and *Paspalum stoloniferum* stomata exist throughout the length of the cotyledon and are not more numerous towards the apex.

Summarizing, in the Graminee examined, stomata are absent in the hypocotylous belt, which is incapable of heliotropic perception. In the cotyledon of oats and wheat stomata abound at the apex, where the heliotropic sensibility is great. Stomata exist also, though in much smaller numbers, in the subapical belt, which possesses only a weak capacity of perception. In the cotyledon of *Panicum* and *Paspalum* the stomata exist throughout the whole length, and the cotyledon is wholly sensible to light. The conclusion may therefore be drawn that in the Gramineae examined the abundance of stomata in young plants corresponds to their degree of heliotropic sensibility.

818 – **The Resistance of Wheats to Winter** (1). — HITIER, H., in *Journal d'Agriculture pratique*, Year 78, Vol. II, No. 29, pp. 82-84. Paris, July 16, 1914.

Last winter M. Schribaux made observations on the resistance to cold of various wheats at the Paris Seed Trial Station and in the field devoted to collections belonging to the Agricultural Institute. The following points were noted.

The varieties from Algeria and the extreme south of France and the hard wheats (Touzelle de Provence and Richelle of Naples) were completely destroyed. Then follow in increasing order of resistance: wheat from the Gironde, Rieti, Belótourka, Polish wheat, Black Russian Petanielle, Japhet, Bordeaux, Autumn Saumur, Saint Laud, Noé, Gros-Bleu and Pithivier (derived from Bordeaux). The hybrids Rieti × Japhet obtained by Schribaux proved decidedly less sensitive to the cold than their parents. Among the English wheats (which stood the winter well) Hunter's was the most resistant.

Among the riveits, Nonette de Lausanne showed great resistance, but of all the wheats examined, Alsatian wheat and the hybrids obtained from it by M. Schribaux (Red Alsatian × Bordeaux and Red Alsatian × Dekat, varieties which are now well fixed) are those that stood the cold best.

According to observations in several parts of France, M. Hitier believes that the damage done to the wheat by frost depends more upon the nature and physical condition of the soil than upon the varieties of wheat used. In heavy soils which had been beaten down by rain all the varieties suffered, while they resisted in permeable soils and in those that had not been compressed.

The greater susceptibility to damage by frost cannot always be attri-

(1) See also No. 620, *B.* July 1914. (*Ed.*).

buted to late sowing, because in several cases the last wheats sown resisted much better than those sown first. On one farm in the department of Aisne and on another in Seine-et-Oise, it was observed that wheat overtaken by frost before it had completely sprouted out of the soil, grew very vigorously as soon as the thaw set in and did not suffer any further injury from the winter. Similar observations were made by M. Schribaux in 1891 and by others also.

It seems that there is a critical period in which wheat is specially susceptible; it is when the radicle is ceasing activity and the adventitious roots have not yet had time to develop; the result is a want of moisture in the leaves.

It may be said, in conclusion, that a whole series of causes exists, which we do not yet know completely and which render a wheat resistant or not to cold.

819 – **Report on the Field Trials with Barleys organized in 1913 by the Barley-growing Station of the Brewers' Institute of Berlin.** — Von Eckenbrecher, C., in *Deutsche Landwirtschaftliche Presse*, Year XXXXI, No. 50, pp. 625-628. Berlin, June 24, 1914.

The comparative trials carried out in 1913 by the Barley-growing Station of the "Versuchs- und Lehranstalt für Brauerei" were intended to test the cultural value of various barleys for brewing purposes. They were made on 14 farms in North Germany, with the six following varieties:

1. Bethge's No. 2.
2. Mahndorf Improved Hanna (Strain C 8).
3. Heil's Improved Franconia.
4. Zeiner's Improved Franconia.
5. Ackermann's Improved Lower Bavarian "Danubia".
6. Ackermann's Improved Lower Bavarian "Bavaria".

Each variety was grown on at least two plots separated by plots under other varieties. No special manure was prescribed; in general, however, abundant quantities of potash and phosphoric acid were used with more moderate dressings of nitrogen. The seeds used were obtained direct from the breeders.

The examination of the product was restricted to the following points: protein content of the dry matter, thousand-grain weight, and grading of the grain. The judges adopted the scoring usually followed in the Berlin barley shows: protein content, weight and uniformity, ranging from 1 point (bad) to 18 (superfine). The nature of the husk and the colour of the grain were also judged, 9 points being the maximum for the former and 5 for the latter.

The results of nine complete trials may be summarized as follows:

The highest average yield of grain was given by Zeiner's Improved Franconia, with 3130 lbs. per acre, but it was rather subject to smut and liable to lodge. It was followed by Ackermann's Danubia (very resistant to smut, but liable to lodge) with 3105 lbs. per acre, and by Bethge's No. 2 (little subject to smut but a little inclined to lodge) with 3095 lbs. per acre. The fourth place was taken by Heil's Improved Franconia with 3040 lbs. per

acre ; this suffered much from smut but stood up well. Ackermann's Bavaria, with 3030 lbs. per acre, possessed great resistance to smut and did not lodge. Last of all was Mahndorf Hanna, which yielded 2945 lbs. per acre ; it was fairly resistant to smut but liable to be badly laid.

The points awarded to the above varieties for brewing quality were as follows :

Zeiner's Improved Franconia	60.1
Mahndorf Hanna	58.9
Heil's Improved Franconia	58.4
Ackermann's Bavaria	57.3
Ackermann's Danubia	54.4
Bethge's No. 2	54.3

820 – **Field Trials of Vegetables: Four Years' Trials of Green Peas, 1909 to 1912.** — SCHULTZE, W. — *Arbeiten der Deutschen Landwirtschafts-Gesellschaft*, Part 253, 69 pp. Berlin, 1914.

The four years' field trials of green peas (1909-12), carried out on several experiment fields in the most important vegetable-growing districts in Germany, were intended to test the respective merits of the various kinds of peas as raw material for the canning industry, especially from the farmer's point of view. Special importance was attached to the time of ripening, to its duration, and to the stature of the plants, as dwarf varieties that do not require staking are to be preferred for the smaller amount of labour and material they require. Consequently early-maturing dwarf varieties were tried side by side with late-maturing tall ones. The preparation of the soil, sowing and cultivation were in every case carried out according to local practice.

Results. — The yields of green peas are subject to much greater variations than those of cereals or hoed crops. These variations are due partly to differences in soil and weather conditions and partly to the varieties of peas grown. In the eleven varieties tried there were striking differences in stature, time of ripening and quality of the crop, so that in certain cases it was difficult to decide which to prefer, as frequently a drawback in one point was compensated for by an advantage in another. Some varieties, however, possess a decided superiority, as may be seen from the following :

1. *Monopol*: plant of low growth (does not require staking), early ripening ; yield barely medium; ratio of the weight of the seeds to that of the hulls good; size of the peas good (the peas are sorted by two sieves, one of 7 mm. and the other of 8 ½ mm. mesh; the larger peas are not esteemed for canning purposes).

2. *Stanley* : a marrowfat pea of low growth, very late ; yield and ratio of peas to hulls low ; small peas too numerous.

3. *Express* : medium growth, very early, medium to good yield; satisfactory ratio of peas to hulls; size of peas satisfactory.

4. *Ueberreich* : medium to tall growth, early, low yield; medium ratio of peas to hulls; size of peas unsatisfactory.

5. *Canning* : marrowfat pea, medium growth, late, low yield; good ratio of peas to hulls; small peas too numerous.

6. *Buchsbaum-Schnabel*: dwarf, very late, good yield, medium to good ratio, very good size.

7. *William Hurst;* marrowfat pea, low growth, early, low yield, good ratio, unsatisfactory size.

8. *Moringia White* (*Teutonia*) : marrowfat pea, low growth, very late, good yield, medium to good ratio, size poor ; very good for drying.

9. *Moringia Green* : marrowfat, medium growth, late, medium yield, good ratio, poor size.

10. *Grünbleibende Folger*: tall, mid-season, good ratio, average size.

11. *Improved Schnabel*; tall, mid-season; yield, ratio, and size all very good.

From the above it is evident that there are dwarf varieties that yield well and possess a good ratio and well formed peas. In general the early varieties have lower yields than the mid-season and late ones, but they are less exacting as to soil and moisture. Owing to their shorter life the moisture they require when sown early is generally provided by the winter rainfall, which is not the case with later varieties, the yield of which is often endangered by dry weather, especially on light soils. The chief aims of practical plant breeding are thus seen to lie in the direction of combining early maturity with satisfactory yield.

The flavour of the peas is less dependent upon the variety grown than upon the weather and perhaps the soil and its state of cultivation.

FORAGE CROPS. MEADOWS AND PASTURES

821 – **Physiological Correlations and Climatic Reactions in Alfalfa Breeding.** — FREEMAN, G. F. (Agricultural Experiment Station, Phoenix, Arizona) in *The American Naturalist*, Vol. XLVIII, No. 570, pp. 353-368. Lancaster, Pa., June 1914.

During the season of 1910, 44 varieties of alfalfa were grown at the Arizona Experiment Station Farm; they were irrigated at the rate of over 6 in. of water for each cutting, and 6 cuttings were obtained during the season ; these were studied with regard to yield and character of the hay and other points.

The correlation between the yield obtained at the first and subsequent cuttings takes the form of a curve beginning and ending high with a sag in the middle, which indicates the presence of some disturbing factor specially noticeable at the fourth and fifth cuttings, and which appears to be the high temperature together with a slight deficiency of water. The presence of this factor is again evident in the disturbance of the normal correlation between the yield and the stand (number of plants on a unit area) at the fourth and fifth cuttings.

The 44 varieties are classified according to their morphological characters and geographical origin into the following groups : Mediterranean, Peruvian, European, American and Turkestan. The reaction of the different groups to the climatic conditions of Arizona is shown by plotting the differences between the average yield of each group and the total average yield at each cutting. The curves thus obtained show that there is a marked similarity between the European and Mediterranean alfalfas, though the better stand of the European varieties makes thes yield always better than the yield of the Mediterranean ones ; European varieties yield

their largest relative crops at the fourth cut and then go off rapidly. The curves of the American and Turkestan groups are again much alike, the Turkestan being slightly above the American strains ; the yields of both groups decrease earlier than the European varieties. The Peruvian group on the other hand are by far the best croppers at the end of the season.

Other correlations show how the nitrogen content of the hay is dependent on the high proportion of leaves in the hay and on the composition of the leaves, but that the stand of the plant has no effect on the proportion of leaves in the hay, though this is always low when the plants are tall or when the total yield of hay is high. Negative correlation was also shown to exist between the height of plants and their stooling capacity (average number of stems per acre).

822 – **The Value of Turkestan Lucerne.** — Bohutinsky, G., in *Monatsheft für Landwirtschaft*, Year VII, Part 3-4, pp. 73-81. Vienna and Leipzig, 1914.

Owing to the increasing importation of Turkestan lucerne seed into Croatia, comparative tests were made in the experiment field of the Royal Agricultural College at Krizevci between this seed and the Hungarian, which is the most important in Croatia. The soil is a heavy loam, containing from 0.4 to 0.9 per cent. of lime ; owing to its tenacity and capacity for water and to the abundant rainfall it is not the most suitable for growing lucerne. Nevertheless lucerne persists for five or six years, yielding from three to five cuts per year on land subjected to garden cultivation during the few preceding years, as was the case with the area on which the experiment was conducted.

Each variety of seed was examined as to its germinating capacity and then sown at the rate of 45 lbs. per acre on two plots each measuring 459 sq. yds. As a cover crop a thin sowing of four-rowed barley was made. The barley was sown first ; then the land was thoroughly harrowed and on April 8,1909, the lucerne was sown. It came up well on the 14th. The growth of both kinds was normal and when the barley was harvested on July 18 they did not differ from each other in appearance. Only later, on both plots, the Hungarian lucerne grew more rapidly and intensely and already in the first year yielded a considerably heavier crop than the other variety.

The experiment was continued during the three following years. Owing to the slower growth of the Turkestan lucerne the plots under this variety showed the very first year many more weeds than the other ones. The two varieties passed the winters 1909-10 and 1910-11 equally well, but during the winter 1911-12 the Turkestan lucerne, which was already very thin towards the end of 1911, fell off further. In the spring of 1913 it was so thin that the plants could have been counted. On the other hand the Hungarian lucerne presented a completely closed surface.

In 1910 the first cut was made on both varieties at the same time, the succeeding two cuts when each variety was in bloom. The yield was about equal, especially because the weeds also contributed to increase the bulk of the Turkestan plots, and also because the first cut was somewhat

too late for the Hungarian variety. In 1911 the cuts were made when this lucerne began to bloom; the result was that it gave five cuts with a considerably heavier yield than the Turkestan, which allowed of only four cuts. In 1912 both varieties were cut four times. The first cut of Turkestan, owing to the grass and weeds it contained, was more abundant than the Hungarian. In the other three cuts only the lucerne plants were weighed; in the second cut the grasses and weeds made nearly half. On the whole the yield of the Hungarian lucerne during the four years exceeded that of the Turkestan by 53 cwt. per acre, notwithstanding the fact that in the latter grasses and weeds were included except for the last three cuts of 1912.

The chief result of the experiment was the demonstration of the much slower aftergrowth of the Asiatic variety. The writer does not draw any conclusion regarding its shorter duration, as its slower growth favours the development of other grasses and this fact alone may lead to the earlier disappearance of the lucerne. Its slowness of growth is alone enough to condemn it as unsuitable for leys.

In order to prevent the trade in this variety, the writer proposes that the seller should be always obliged to declare the origin of certain inferior varieties and that the seed control stations should no longer seal the sacks containing it : the Hungarian stations have since 1909 stopped sealing the packages of this variety and have succeeded in the object aimed at.

SUGAR CROPS

823 – **Connection between Available Space, Weight and Sugar Content of Beets and Mangolds.** — MUNERATI, O., MEZZADROLI, T., and ZAPPAROLI, F. V., in *Bollettino dell'Associazione italiana delle Industrie dello Zucchero e dell'Alcool*, Year III, No. 1, pp. 6-12. Bologna, April 1914.

In the experiments conducted during 1912 and 1913 three groups were formed : one consisted exclusively of sugar beets, the second of mangolds and the third of a mixture of the two. They were sown in a field and in boxes 6 ft. 6 in. square by 3 ft. 3 in. deep containing different kinds of soil. The seeds were all of the same kind, and were sown on the same day. The results are summarised as follows :

1. Between the available space for each plant and the weight of individual beets there is no constant connection. While usually beets with plenty of available space are larger, yet very fine beets are also found where the plants are close together, and the reverse also is often the case.

2. The weight which some beets attain depends markedly upon the soil and, in equal soils, upon the season.

3. Exceptionally large beets occur much more seldom when they have much available space upon poor soil than upon a rich one.

The above observations are equally true for beets, mangolds, and semi-sugar beets.

4. Mangolds growing near beets do not affect the development of the latter.

5. Even in the most uniform soil imaginable (such as that in the boxes) and with the same treatment, the same variations and differences occur.

6. The differences between individual plants growing in the same

conditions of soil appear also in the shape of the roots and behaviour of the tap-root.

7. Even in sugar content noticeable differences are observed in beets growing in the same soil. Not only does the percentage of sugar vary according to the weight and form of the roots, but beets of the same weight and form and growing in the same soil during the same period may present very remarkable differences in the percentage of sugar they contain.

824 – **Coffee Cultivation in Uganda.** — SMALL, W. (Department of Agriculture, Uganda) in *Bulletin of the Imperial Institute*, Vol. XII, No. 2, pp. 242-250. London, April-June 1914.

STIMULANT, AROMATIC, NARCOTIC AND MEDICINAL CROPS.

Coffee is the staple crop of European planters in Uganda ; exports have risen from about 10 tons in 1908 to 167 tons in 1912-1913, and are still rising as the estates gradually come into bearing ; the exports for the 9 months ending December 31, 1913, were double those for the whole preceding year. There were 4 568 acres under coffee and 2 659 acres under rubber and coffee in March 1913.

The indigenous coffee plant is *Coffea robusta*, but this is only cultivated by the natives and consumed locally ; Europeans plant the so-called Nyasaland and Bourbon varieties, said to have been imported from Jamaica and Aden respectively and both derived from *C. arabica*. Little care has been taken so far with seed selection, but both these varieties thrive well and yield heavy crops the fourth year. The outbreak of coffee leaf disease at the end of 1912 and the epidemic in 1913 led planters to give some attention to other forms of coffee, and experiments are now being carried out with *C. liberica*, *C. stenophylla* and *C. robusta*. With regard to climate, soil and altitude, Uganda is eminently adapted to the production of coffee.

The question of permanent shade in coffee plantations is still in the experimental stage ; results obtained up to the present have not been favourable to permanent shading, but the matter has not yet been given a sufficiently extensive trial. The silky oak (*Grevillea robusta* A. Cunn.) is being tested for this purpose and various species of Leguminous trees, also para rubber trees which have the advantage of being profitable and the disadvantage of being subject to a root disease which also attacks coffee. The question of cover crops is also being investigated.

The strong, steady winds which occur periodically in certain parts of the country have to be guarded against, and high or low wind belts can be made with various trees, bananas being a favourite subject as they provide food for the native population at the same time.

Hemileia disease is endemic in Uganda and its apperance in the form of an epidemic in 1913 may be attributed to the fact that it was suddenly provided with a new host plant ; despite the prevalence of this disease, the outlook is favourable, for the indications are that its virulence will be less in the future than in the past ; the fungus, being endemic in Uganda, cannot be expected to work the havoc that it has wrought in other countries into which it was introduced. Planters are recognising that much depends on their efforts to eradicate it, and the Department of Agriculture is alive

to the situation. In dealing with white ants (termites), exterminators have been used with success. The ravages of these pests are unequal, and in some parts they have caused little or no damage to growing plants.

825 – **Production of Vanilla in the French Colonies.** — *Ministère des Colonies, Bulletin de l'Office Colonial*, Year 7, No. 77, pp. 209-249. Melun, May 1914.

Martinique. — Vanilla was introduced into this colony a long time ago (about 1697), but its cultivation has not spread much and it seems at present to remain stationary. During the four years from 1908 to 1911 the greatest exportation took place in 1909 (4 590 lbs., worth about £1520), the least in 1911 (2536 lbs., worth about £955).

Guadeloupe. — *Vanilla planifolia* was introduced in 1701 ; artificial pollination was begun in 1839, and a few years later the exportation of vanilla began ; in 1911 it amounted to 39 267 lbs., of the value of £13 352. The greatest quantity was exported in 1908 : 68 242 lbs., worth £10 871. Besides Mexican vanilla (*V. planifolia*), the native vanilla (*V. pompona*) is also grown to some extent.

Guiana. — *Vanilla planifolia* was introduced about the year 1870 by the Administration of the penal settlement, but it dit not gain a footing and its cultivation is now abandoned.

Gaboon. — The cultivation of *V. planifolia* has developed gradually during the last fifteen years. The vanilla exported in 1911 was 891 lbs., worth about £1102. Vanilla has often been found wild in both the French and Belgian Congo.

Mayotte and dependencies. — Vanilla has been cultivated in the Comoro Islands since 1875. At present it is the principal crop of the archipelago ; in 1909 the crop amounted to 91 525 lbs. The greatest quantity is produced by the island of Anjouan (1 200 000 plants) ; the quantity harvested in 1908 was 59 342 lbs., worth £32 031 ; the island of Mohéli gives the best quality. Mayotte possesses about half a million plants.

Madagascar and neighbouring islands (1). — Vanilla is not native to the island, but it is now widely spread, especially along the east coast. The neighbourhood of Tamatave seems to be too moist for *V. planifolia*, but might perhaps be suitable for other species. In 1891 there were already at and round Vatomandry about 181 000 plants, and during the last twenty years this crop has attained real importance in the island, especially in the provinces of Vohemar and Antananarivo, in the districts between Andevoranto and Mananyari. In Madagascar it does not encounter any serious natural obstacles, but the market is limited and the island is near other competing centres of production, such as Réunion and the Comoro Islands, the plantations of which are in full bearing and producing a vanilla which enjoys great repute. The exports began to be important in 1896 ; in 1911 they reached 115 589 lbs., worth £87 452. The vanilla of Nossi-Bé is especially renowned, but, like all Madagascar vanillas, is somewhat lacking in perfume.

Réunion. — Vanilla has been grown in this island for about a century,

(1) See also No. 635, *B.* July 1914. (*Ed.*)

and it has also been exported for a long time, but it was only after 1862 that exportation became considerable. The so-called "vanillon" (the exportation of which began in 1884) is not *V. pompona* but the pods of *V. planifolia* less than 5 ½ inches in length. The cultivation of vanilla is somewhat decreasing in Réunion, but the island still occupies one of the foremost positions among the countries producing this commodity. Almost the whole of the crop is exported. The graph of the exports from 1896 to 1911 presents two maxima, in 1898 and in 1902, respectively 442 046 lbs., worth £273 057, and 439 526 lbs., worth £107 196 ; in 1911 it was 146 610 lbs., worth £73 606.

Bourbon. — Vanilla is grown almost everywhere up to 100 ft. above sea-level ; it thrives better, however, in the windward part of the island than in the leeward. Bourbon vanilla ranks in the trade as a vanilla having a strong perfume, while in Mexican vanilla the perfume is delicate and sweet.

New Caledonia. — It appears that vanilla was introduced about 1861 and that only parts of the island are suitable to its cultivation. Experiments carried out on medium soils in the neighbourhood of Nouméa gave good results, but then the introduction of coffee raised more interest and vanilla was abandoned. In 1901 234 lbs., worth £127, were exported, but in 1911 only 2 lbs.

Tahiti. — *V. aromatica* was introduced in 1848 and is now widely spread. It is grown chiefly by the natives ; the pods are picked too soon and their preparation leaves a good deal to be desired ; the result is that the produce is sold at a low price, chiefly to Germany and the United States. In 1902, 318 525 lbs. were exported, representing a value of £47 493 ; in 1903, 289 761 lbs,, worth £23 461. After 1904 the exports from Tahiti are included in those from Oceania, which comprises Tahiti and Moorea. In 1911 it amounted to 467 567 lbs., worth £95 944.

French establishments in India. — At Pondicherry vanilla was introduced into the botanic gardens of the colony about 1879. The production began to be regular after 1888 ; it reached a maximum in 1901, with 280 lbs., worth £175. The soil and climate of the French establishments in India are not suitable to this crop, and the prices realized are not sufficiently remunerative.

Indo-China. — Vanilla was introduced about 1865 to the botanic gardens of Saïgon, but it has not gained a footing in the country.

The exportation of vanilla from all the French colonies amounted in 1911 to 948 988 lbs., worth £389 832. The French colonies produce about two-thirds of the vanilla produced in the whole world. Its consumption in France between 1907 and 1912 was about 132 300 lbs. per annum.

826 – **Nicotine in the By-products of the Cultivation of Tobacco** (1). — CHUARD, E., and MELLET, R., in *Compte-rendus hebdomadaires des Séances de l'Académie des Sciences*, Vol. 159, No. 2, pp. 208-209. Paris, July 13, 1914.

Through the investigations carried out by the writers, in 1911, into the variation of the proportion of nicotine in the several organs of the

(1) See No. 1424, *B.* Oct. 1912. (*Ed.*).

tobacco plant during the course of development, it was ascertained that the offal of the crop as it is raised in Switzerland contains considerable quantities of the alkaloid. This waste consists of tips and axillary shoots before the leaves are gathered ; stems, roots and shoots after the leaves are gathered. This waste, when used green, in order to avoid the loss of nicotine due to esiccation, is an important raw material for the preparation of the titrated solutions used as insecticides.

Experiments were undertaken in 1913 with a view to ascertaining the possibility of increasing the yield of nicotine in these waste products by suitably modifying the methods of cultivation of the plants and their treatment after the leaves had been gathered, without damaging the quality and the quantity of the chief product ; the following methods were tried : 1) allowing the axillary shoots to grow instead of removing them as they appeared ; 2) at harvest time gathering only the largest leaves, leaving in the ground all the stems provided with the recently formed shoots ; 3) treating with nitrate of soda the plants thus partially deprived of their leaves.

From the analysis of the plants thus treated the writers draw the following conclusions :

1. The plants not deprived of their shoots are on the whole less abundant producers of the alkaloid (1.305 gm. nicotine per untouched plant against 1.891 gm. in the others), and this independently of the serious harm done, by not removing the shoots, to the quantity and quality of the main crop.

2. The yield of nicotine of the plants left in the field after the harvest with the small shoots recently formed in the axils of the large leaves is much superior (0.942 gm. nicotine per whole plant against 0.432 gm.) to that of the plants completely stripped.

3. Treating with nitrate of soda does not regularly modify the relative content of the different organs of the plant, but increases the absolute production of alkaloid per individual by favouring its growth (with nitrate 0.739 gm. nicotine per completely stripped plant and 1.288 gm. per partially stripped one). Thus nitrate is not a direct producer of nicotine (A. Mayer).

The writers conclude that it would not be advantageous, even from the point of view of the production of nicotine, to allow the growth of the axillary shoots which are formed before picking, instead of removing them as they appear, but that the returns from the utilizable by-products (according to the method of cultivation adopted in Switzerland) may be considerably increased by giving nitrate of soda to the plants that are left standing after the harvest, during which they are deprived only of their large leaves.

827 – **Experiments in Growing Medicinal Plants at Korneuburg in 1913** (1). — (Communication of the National Committee for the Encouragement of the Cultivation of Medicinal Plants in Austria, No. 17). SENFT, E. in *Zeitschrift für das Landwirtschaftliche Versuchswesen in Oesterreich*, Year XVII, Part 3-4, pp. 129-182. Vienna, March-April 1914.

After some general observations on the cultivation of medicinal plants in Austria and on their disposal, the writer enumerates the chief pests which attacked them in 1913. Thus it is remarkable that white grubs attacked almost all the poisonous and aromatic plants, such as *Atropa, Hyoscyamus, Datura, Angelica, Valeriana, Anacyclus, Pyrethrum* and others, and respected only *Conium* and *Levisticum*. He then gives detailed information on the sowing, manuring (in some cases), development, pests, harvest and yield of the following plants : marsh mallow (*Althaea officinalis*), hollyhock (*Althaea rosea*), pyrethrum (*Anacyclus officinarum* and *Anacyclus pyrethrum*), annual and biennial angelica (*Angelica archangelica*), *Anthemis nobilis*, wormwood (*Artemisia Absynthium*), estragon (*A. Dracunculus*), deadly nightshade (*Atropa Belladonna*), blessed thistle (*Cnicus benedictus*), Caucasian pyrethrum (*Chrysanthemum* [*Pyrethrum*] *carneum*), Dalmatian pyrethrum (*Chrysanthemum cinerariaefolium*), scurvy-grass (*Cochlearia officinalis*), foxglove (*Digitalis purpurea*), yellow gentian (*Gentiana lutea*), *Grindelia robusta, Gypsophila paniculata, Hydrastis canadensis*, henbane (*Hyoscyamus niger*), hyssop (*Hyssopus vulgaris*), elecampane (*Inula Helenium*), German iris (*Iris germanica*), lavender (*Lavandula Spica*), lovage (*Levisticum*), liquorice (*Liquiritia*), mallow (*Malva sylvestris*), balm (*Melissa officinalis*), mints (*Mentha canadensis, M. crispa, M. viridis*), peppermint (*M. Piperita*), marjoram (*Origanum vulgare*), *Panax quinquefoliuum*, opium poppy (*Papaver somniferum*), parsley (*Petroselinum sativum*), rhubarb (*Rheum*), rue (*Ruta graveolens*), sage (*Salvia officinalis*), sclary (*Salvia Sclarea*), soapwort (*Saponaria officinalis*), comfrey (*Symphytum officinale*), tansy (*Tanacetum vulgare*), thyme (*Thymus vulgaris*), valerian (*Valeriana officinalis*), mullein (*Verbascum phlomoides*).

The number of species planted in the botanical garden during the year 1913 was 140. Among them there are some North American medicinal plants which thrive well, especially *Spigelia marylandica, Asarum canadense, Hamamelis virginiana, Grindelia robusta* and *Hydrastis canadensis*.

828 – **The Influence of Soil and Manures on the Yield, Chemical Composition, Size and Quality of Strawberries.** — VERCIER, J., in *Journal de la Société Nationale d'Horticulture de France*, Vol. XV (4th Series), pp. 349-375. Paris, May 1914. FRUIT GROWING

Plant food removed by strawberries. — This was estimated not only in the fruit harvested during one season but also in the vegetative organs of the plant representing one year's growth ; the following results were obtained (Table I) :

(1) See also No. 1155, *B.* Oct. 1913 ; No. 1345, *B.* Dec. 1913 ; and pp. 26-30, *B.* Jan. 1914, article by Dr. BÉLA PÁTER: Cultivation of Medicinal Plants in Hungary. (*Ed.*)

TABLE I. — *Removal of plant food from the soil by strawberries (lbs. per acre).*

	Total crop		Nitrogen	Phosphoric acid	Potash	Lime and Magnesia
	Green	Dry				
Removed by fruit, including calyxes and peduncles:						
in 10 English varieties . . .	13 400	4 800	45.32	41.46	43.40	22.18
(composition per 100 parts green weight).			(0.338)	(0.310)	(0.324)	(0.166)
in Alpine varieties	10 700	5 600	86.36	51.26	85.80	35.10
(composition per 100 parts green weight)			(0.806)	(0.478)	(0.801)	(0.328)
in 3 perpetual-fruiting varieties	13 800	7 200	90.00	46.78	93.55	34.55
(composition per 100 parts green weight)			(0.650)	(0.338)	(0.676)	(0.250)
Removed by vegetative organs:						
in 10 English varieties . . .	3 200	1 200	13.91	11.80	13.67	45.98
(composition per 100 parts dry weight)			(1.17)	(1.00)	(1.15)	(3.87)
in Alpine varieties	1 200	500	9.28	5.46	4.81	12.70
(composition per 100 parts dry weight)			(1.83)	(1.08)	(0.95)	(2.51)
in 3 perpetual-fruiting varieties)	2 400	1 060	13.90	0.90	7.54	29.46
(composition per 100 parts dry weight)			(1.30)	(0.85)	(0.71)	(2.78)
Total removed by crop:						
in English varieties			59.23	53.26	57.07	68.16
» Alpine »			95.64	56.72	90.61	47.80
» perp. fruiting »			103.90	47.68	101.09	64.01

The figures for phosphoric acid are relatively high, as the soils of the experimental fields were rich in this element.

The effect of manures. — The effect of different manures on the size of the fruit was investigated on various soils; the results are given in Table II.

TABLE II. — *Average weight of strawberries (Sharples) in grams.*

Soil	Control	Complete manuring	No potash	No nitrogen	No phosphoric acid	Slag alone	Potash alone	Organic manures
A	10.5	10.7	—	10.5	—	—	—	—
B	10.4	—	—	—	—	10.6	—	—
C	6.4	9.2	—	—	—	—	7.5	—
D	9.5	9.6	11.8	9.4	10.1	—	—	12.5
E	—	—	—	—	—	—	9.4	9.7
F	8.3	8.6	—	—	—	8.3	8.9	9.3

The influence of manures on the period of ripening was also examined, but though manured plots in general may be said to ripen earlier than unmanured plots, the various manures produced very irregular effects in this connection.

The influence of manures on the flavour of the fruit is given in Table III:

TABLE III. — *Influence of manuring on flavour of strawberries.*

Manurial treatment	Points	Remarks
I Unmanured	80	Typical flavour.
II No nitrogen, but slag and sulphate of potash	60	Flavour reduced, not so sweet.
III Complete manuring, slag, sulphate of potash and nitrate	63	Flavour reduced, very slight acidity.
IV No potash, but slag and nitrate	93.5	Very fine flavour, large fruits.
V No phosphoric acid, but sulphate of potash and nitrate	75.5	Fairly sweet and with a pleasant taste.
VI Organic manure: compost, blood and cake residues	79	Fruit well filled and with a pleasant taste.

Though the absence of potash raises the quality of the fruit, it also decreases the total amount of the crop.

The influence of manures on the chemical composition of the fruit is given in Table IV.

TABLE IV. — *Influence of manuring on chemical composition of strawberries.*

Soil	Manurial treatment	Yield of juice, per cent.	Sugar, in gms. per litre	Acidity, in gms. of H_2SO_4 per litre
A	Unmanured	54	63	6
	Dung	57	65	5.2
	Complete fertilizers and dung	56	73	5.9
	Slag and sulphate of potash	59	65	5.6
B	Unmanured	77	56	4.7
	Slag	68	67	5.0
C	Unmanured	54	63	6.0
	Potash	58	68	6.2
	Complete fertilizers and dung	56	56	5.5
D	Dung	86	86	6.4
	Slag and sulphate of potash	85.5	81	6.4
	Complete fertilizers	79.7	83	6.3
	Slag and nitrate	75.1	80	6.3
	Sulphate of potash and nitrate	81.3	80	6.3
	Compost, blood and cake residues	80.2	78	6.2

Influence of the soil on the fruit. — The following points for flavour were awarded by expert tasters to samples of fruit grown on different soils ; the two trials were carried out separately (see Table V).

TABLE V.

Variety	Soil	Points	Remarks
1st *trial* : Sharples	containing a fair amount of organic matter	80	typical.
	light sandy loam	109	best flavoured.
	low-lying sand	53	rather watery.
2nd *trial* : Vicomtesse Héricart de Thury	rich wheat land in good condition	30	slightly acid.
	very light, non calcareous	39	full flavoured, firm and dense.
	poor gravel	38	full flavoured.
	marly	26	flavour less good.
	gravelly sand with 9 per cent. carbonate and iron salts	30	full flavoured.

Analyses of the fruit from different soils are given in Table VI.

TABLE VI.

Soil	Yield of juice per cent.	Gms. of sugar per litre	Acidity in gms. of H_2SO_4 per litre
Slightly sandy	57	65	5.2
Low-lying sand	77	56	4.7
Sandy hillside, unmanured for 5 years	54	63	6.0
Garden	86	86	6.4

In another set of experiments the changes taking place during the maturation of the fruit were investigated and it was found that the acidity gradually diminished, while the amount of reducing sugars increased.

The chemical composition of 16 varieties is given and various schemes of manuring are discussed in the paper.

829 – **Fruit and Vine Growing in Central Asia.** — BARSACQ, JOS., in "*Zapiski*" *Simferopólskavs Otdiéla I. R. obschtchestva Sadovodatva*, No 142, 1914.

I. *Fruit growing.* — In Russian Turkestan there are 29 123 dessiatines (78 632 acres) under fruit, mostly in the form of small native orchards, though of late years there has been a distinct tendency towards the establishment of larger orchards, up to 250 acres or more in extent, by the Russian colonists.

Of all fruits, *apricots* are the most common and are not only consumed locally in enormous quantities but also exported to Siberia ; a succession of varieties assures a constant supply from May to August. The next most common fruit is the *peach* ; a flat-fruited variety known as "Cheftalé injir" is very popular, while the local varieties of nectarines are better than the European varieties. *Mulberries* are an important crop not only for the sake of their fruit but also as food for silkworms ; the large fruited seedless varieties are eaten raw, or made into a kind of sirup which is used as a sugar substitute, or even dried and made into a kind of flour which is used as a substitute for bread in very out-of-the-way districts. *Walnut* trees are common in the forests of Ferghana, which, according to the most recent statistics, extend over 35 000 dessiatines (94 500 acres); walnuts are represented chiefly by a large fruited and by an early dwarf variety. Local varieties of *apples* and *pears* are few and worthless, but European varieties, more particularly those cultivated in Crimea, have been introduced by Russian colonists and excellent results have been obtained in the Vierny district with Aport or Grand Alexandre ; in the neighbourhood of the large Turkestan cities, especially Tashkent where fruit growing is developing with rapid strides, satisfactory varieties have yet to be selected, for shallow rooted stocks such as paradise or quince yield poor

specimens of trees and probably suffer from the great summer heat (up to 122° F.) and the drought.

As regards management, in order to keep down weeds, which are a serious pest, lucerne is sown in the orchards with excellent results; pruning is only practised in a very primitive fashion ; the orchards are irrigated four or five times during the course of the summer. Flowering takes place about one month before it does in the Crimea, and late spring frosts are liable to cause very extensive damage, especially to the hard fruits.

With regard to diseases, codling moth (*Carpocapsa pomonella*) is by far the most destructive and affects up to 80 and 100 per cent. of the apples ; this insect, though native, has few natural enemies and an attempt was made to introduce *Oophthora semblidis* and other of its internal parasites, but without success. As the moth has three broods in a season, the late varieties of apples suffer most and 75 per cent. of their fruits are attacked as against 20 per cent. of the early varieties. Preventive and remedial measures employed successfully in other parts of the world, such as spraying, trapping, grease-banding, seem useless in Turkestan, but certain large growers have adopted the method of bagging their fruit and the practice seems to be spreading. *Tingis piri*, apple sucker (*Psylla*) and its allies, *Polyphylla adspersa* var. *pulverea*, *Melolontha afflicata*, *Rhizotrogus solstitialis*, *Tropinota turanica*, *Oxythyrea cinetella*, *Cetonia margicollis* also cause serious damage. Owing to the almost complete rainlessness of the summers fungoid pests are rare. Certain choice varieties of apples are frequently affected by so-called "Stippigkeit", which is thought to be of physiological origin though its cause is at present unknown ; the disease is characterised by corky filaments under the epidermis which appear usually after picking, and it is spreading in a somewhat alarming manner.

Turkestan apples are inferior in quality to Crimean apples and the writer does not consider that the country will ever be capable of producing any but lower grade fruit ; this produce will find an outlet in Siberia, which is being connected up direct with Turkestan by a railway. Early varieties of fruit will also be marketable in Russia, as they ripen about a month earlier than the crop in the European temperate regions.

II. *Vine growing*. — It is estimated that 25 000 dessiatines (67 500 acres) are at present under vines, of which 13 000 dessiatines (35 100 acres) are in the Samarkand district. Small vineyards are the rule. The writer gives a detailed account of cultural methods practised by the natives, including irrigation, which consists of five or six waterings during the summer.

As the Mahommedan law prohibits the use of wine, the varieties usually cultivated, amounting to about 40, are all table fruit with thick skins, few or no pips, and firm pulp ; they grow in long loose bunches. About three quarters of the vineyards are planted with Kichmich, which is dried to produce currants. Masca is a very large kind with bunches averaging 3 lbs. in weight and sometimes reaching 10 lbs., while each grape may have a diameter of 1 ½ in. ; the fresh fruit is in good demand not only locally but also in Moscow and Petrograd. Khoussaïné is a common variety in the neighbourhood of large cities and is exported to the north

under the name of Ladies'-fingers; it keeps well and is a heavy cropper, producing 1 000 to 3 000 poods per dessiatine (13 000 to 40 000 lbs. per acre). Early varieties such as Ak-tchiliaku, which ripens at Tashkent about the middle of June, have also been cultivated of late years.

Russian colonists have tried certain European wine-making varieties, but though the vines appear to have become thoroughly acclimatised and yield good crops, the wine is of poor quality.

The exportation of fresh grapes to Russia is capable of great developments and is receiving encouragement from the Government in the shape of a supply of cold-storage trucks and an accelerated railway service; exports have increased steadily since the opening of the Tashkent railway.

The dried raisin industry, too, is worthy of encouragement, for the climatic conditions are eminently suitable for the drying process and the produce could be vastly improved by the introduction of more up-to-date methods. About 1 250 000 poods (45 million lbs.) of dried raisins and currants are sent annually from Turkestan to Russia and another two million poods, consumed by the latter country, are furnished by Persia and Greece when they might easily be produced in Turkestan.

Wine making, on the other hand, suffers on account of the great summer heat and excessive sweetness of the grapes and has made little progress; white wines are coarse and have a bitter after taste, especially when made with local table varieties; the writer is of opinion that ordinary table wines will never be greatly improved unless the processes of vinification are considerably modified, but there are great possibilities as regards the production of sweet wines with a high alcohol content. The manufacture of brandy has been attempted by a few firms, but without much success, as only a coarse high coloured spirit has been obtained.

Phylloxera is unknown in Turkestan, while fungoid pests are rare, being limited to oïdium and *Cercospora*. The most serious enemies are certain birds which destroy large quantities of grapes in some places; dogs too do considerable damage, as they are rarely fed by their native owners and grapes represent a welcome addition to their diet.

LIVE STOCK AND BREEDING.

830 – **Experiments on the Control of Warble Flies in Germany** (1). — SCHÖTTLER and GLÄSER, in *Mitteilungen des Ausschusses zur Bekämpfung der Dasselplage*, No. 6, pp. 1-31. Berlin, 1914. HYGIENE

In 1913 the Warble Control Committee undertook the treatment of the cattle in the district of Neuhaus on the Oste; out of a total of 3892 head, 2933, or 75.4 per cent., were freed from warbles; the number of larvae removed was 47 625, that is an average of 16.2 warbles per head. The work was done in the second half of April shortly before the cattle were turned out to graze; the average time for dealing with each animal was a quarter

(1) See also No. 534, *B* June 1914. (*Ed.*)

of an hour. The larvae were either squeezed out by hand or extracted by means of tweezers. Most of the cattle kept fairly quiet during the operation, and in only 21 cases did a slight nettlerash follow. The total cost amounted to 423.70 M. (£20 15 *s* 5 *d*), or 0.89 Pfg. (0.11 *d*) per larva, and for each of the 3892 head of cattle existing in the district a little over 1 *d*. This is about the price paid formerly in Oldenburg for removing warbles. The cost, however, varied from one locality to another and with the kind of cattle. Heifers and steers were the most affected with warbles, while cows had not so many, though they were certainly not free from them; bulls had the lowest percentage of warbles. Considering the depreciation of each hide due to warbles to be 3.89 M. (3 *s* 9 $^{3}/_{4}$ *d*), the loss of the farmers in the district under consideration was about £ 560. If the reduction in the amount of flesh laid on and the check in the growth of the young cattle be also taken into account, the loss would probably be twice as much.

In a second part of their paper the writers report upon last year's campaign against warble flies in the district of the Wesermarsch Herdbook Association in the Grand-duchy of Oldenburg, where for several years it has been compulsory to free cattle from warbles. In order to give an idea of the success of the control of warbles the Chamber of Agriculture, by means of the communal authorities, distributed among the owners of cattle upwards of 13 700 question-sheets; 3000 replies containing sufficient data were arranged statistically. The extraction of warbles in Oldenburg was carried out in most of the cases by the owners themselves and only exceptionally by professionals, who in general were more successful than the former. The number of cattle to which the replies referred was 42 593, that is 40.60 per cent. of the whole stock of cattle in the district; of these, 27 870 head or 64.43 per cent. bore warbles. The percentages were: cows 66.35, heifers 87.69, steers and bulls 85.81, and calves 8.58. In the herds examined there were 312 495 warbles, which would give about 770 000 for all the cattle of the district, or 7 or 8 per head of the whole and 11 or 12 per animal infected. The lowest number was found on the calves, which had barely one each, while the cows had 4 or 5 and the steers 12 or 13. The total number of larvae killed was 204 184; the greatest freedom from warbles was obtained where the operation was repeated in May. On the "Geest" (high-lying land) pastures the cattle suffered more from warbles than on the marsh pastures on account of the greater dryness of the former. The same had been observed also at Neuhaus on the Oste.

Lastly the writers report an experiment made by them to demonstrate that the warble larvae caused the cattle to lay on less flesh. Ten steers were kept under exactly the same conditions, five being freed from warbles and the others not. The result was that the former gained an average of 37.3 lbs. per head more than the others. Thus it appears that the loss in flesh caused by warbles is still greater than the loss caused by damage to the hides.

331 – **Effect of Long Storage of Meadow and Clover Hay on its Composition and Digestibility.** — HONCAMP, MÜLLNER and STAU, in *Die landwirtschaftlichen Versuchsstationen*, Vol. 84, Part 5-6, pp. 447-481. Berlin, June 16, 1914.

I. *Meadow hay.* — The hay used in this experiment had been stored for six weeks in a hay loft; it was then chaffed, uniformly mixed and wrapped in paper to prevent losses of any portion of it. After this it was kept for three years in a large airy room not heated in the winter. The samples were analysed: 1) at the beginning of the experiment; 2) after a year and three-quarters; 3) after three years. The results of the three analyses did not differ to any extent from each other.

In the digestibility trials, the hay was fed to two sheep at the rate of 1.54 lbs. per head per day at five different periods. The average coefficients of digestibility obtained are shown in Table I (averages of the two sheep).

TABLE I.

Period	Dry matter %	Organic matter %	Crude protein %	N-free extract %	Crude fat %	Crude fibre %
I. August 1909	58.9	60.8	68.0	59.6	48.2	59.8
II. May-June 1910 . . .	60.4	62.5	68.3	62.6	48.1	61.6
III. May 1911	59.6	61.3	69.6	60.5	46.0	59.7
IV. February 1912 . . .	58.0	59.8	67.4	58.1	51.5	59.5
V. Aug.-Sept. 1912 . .	59.8	61.5	68.8	60.5	51.1	61 –
Increase of digestibility in 5th period as compared with 1st.	0.9	0.7	0.8	0.9	2.9	1.2

The digestibility of meadow hay has thus remained very constant during the three years and has in nowise suffered from the long storage; the variations of digestibility observed fall within the limits of experimental error. The writers conclude that by proper storage with suitable ventilation meadow hay does not suffer any loss either in its nutritive contents or in its digestibility, and that the different results obtained by other observers are due to losses caused by mechanical action, such as the dropping of the leaves rich in nitrogen and consequent proportional increase of the more fibrous stalks, or by lack of proper precautions in sampling.

II. *Clover hay.* — The clover hay used consisted of 60 per cent. clover and 40 per cent. ryegrass; it was chaffed and well mixed, part being wrapped in paper and part placed in a dry loft. It was kept for two years, and during this time did not show any change in its content of nutritive matter. For the experiments on its digestibility it was fed to two sheep in six different periods. The average coefficients of digestibility for the two sheep are given in Table II.

TABLE II.

Period	Organic matter %	Crude protein %	N-free extract %	Crude fat (Ether extract) %	Crude fibre %
I. July-Aug. 1911	62.9	65.0	66.0	58.9	56.5
II. Dec.-Jan. 1911-12	61.9	60.8	67.2	55.3	54.0
III. Sept. 1912	62.7	62.4	67.4	56.0	55.5
IV. Sept.-Oct. 1912	60.2	60.2	65.3	53.4	52.4
V. Sept. 1913	61.8	60.7	66.9	61.4	54.0
VI. Sept.-Oct. 1913	60.0	60.7	63.9	56.4	53.7
Decrease of digestibility in the 6th period as compared with the first	— 2.9	— 4.3	— 2.1	— 2.5	— 2.8

During the periods 1, 2, 3 and 5 the hay fed was taken from the paper wrappers and during periods 4 and 6 from the loft.

The differences in the digestibility during the various periods are so small as to lie within the limits of experimental error. The writers therefore conclude that clover hay does not suffer any loss either in its nutritive contents or in its digestibility.

With both meadow hay and clover hay the valuation according to botanical analysis agreed with that based on the digestible protein and on the starch value ; on the contrary valuation according to crude protein and crude fibre content did not agree with valuation according to botanical analysis.

The classification of fodder is therefore to be based exclusively on its content in digestible protein and starch value.

832 – **The Value of Different Kinds of Straw as Fodder.** — HONCAMP, RIES and MÜLLNER, in *Die landwirtschaftlichen Versuchsstationen*, Vol. 84, Part 5-6, pp. 301-398. Berlin, June 16, 1914.

This is a critical study on the present views, mostly based upon old experiments of Henneberg, Wolf and others, on the food value of different kinds of straw. The investigations dealt with the straw of barley, oats, wheat, rye, spelt, peas, lupins, rape and colza. Each kind of straw was examined as to its content in organic matter (according to the usual methods) and inorganic matter and crude fibre (according to König, Weender, Cross and Bevan) ; it was then fed to two sheep in order to ascertain its digestibility.

As the weather is said to influence the chemical composition of straw and also to a certain extent its digestibility, the straw of the very dry year 1911 was compared with that of the wet year 1912, as far as possible. In most cases the different straws were taken from the same farms. The

wheat straw was mixed with hay and 0.66 lb. of it was given to each sheep per diem. The straw of Cruciferous and of Leguminous crops was fed at the rate of 1 lb. per day and mixed with beet-slices, soy-meal and hay.

The results are summarised by the writer as follows :

1. The general opinion that spring grain straw is poorer in crude fibre than the corresponding winter grain straw is in many cases erroneous.

2. The weather conditions have in general a relatively small influence on the percentage of organic and inorganic matter in the different straws, or at least this influence is not so marked as in fodders richer in protein.

3. König's crude fibre method gives mainly a pentosan free crude fibre, which is not the case with Weender's method. To this is probably due, in many cases, the lower yield of crude fibre by the former method. König's method for the determination of pure cellulose is not correct; at present Cross and Bevan's method is more trustworthy.

4. The straws of spring and winter grain can be considered of equal value as to their digestibility. The straw of Cruciferae (rape and colza) is inferior in value to cereal straw, while the straws of Cruciferae and of Leguminosae are about equal.

5. The value of a fodder is correctly expressed only by its starch value. The classification of fodders according to protein and crude fibre content leads in general to erroneous conclusions.

833 – **The Contribution of Bacteria to the Feces after Feeding Diets Free from Indigestible omponents.** — Osborne, T. B., and Mendel, L. B. (Connecticut Agricultural Experiment Station) in *The Journal of Biological Chemistry*, Vol XVIII, No. 2, pp. 177-182. Baltimore, Md., July 1914.

The feces of 17 rats fed on various diets entirely free from indigestible components were investigated with a view to determining what proportion of the excrement was made up of dead bacterial bodies. The special diets consisted of protein, starch, protein-free milk (1), and lard, so that it was possible to avoid the great difficulty always encountered in previous experiments of separating the bacterial cells from fragments of more resistant undigested food. The feces were dried and ground ; the powder thus obtained was then successively extracted with ether, alcohol (absolute and 80 per cent), 0.2 per cent. hydrochloric acid, and absolute alcohol containing 0.2 per cent. hydrochloric acid. The final residue varied from 22 to 41 per cent. of the dried feces and its nitrogen content calculated on an ash-free basis was fairly constant, amounting to from 10.7 to 12.2 per cent., which corresponds closely to numerous recorded analyses of bacterial cellular substance. Microscopical examination also suggested that the residue consisted of an almost uncontaminated mass of bacterial bodies.

(1) See No. 1171, *B.* Oct. 1913 ; No. 142, *B.* Feb. 1914. (*Ed.*).

HORSES, ASSES AND MULES

834 - **The Breeds of Horses in Norway.** — *Communication from* CHR. WRIEDT, *presented by the Delegate of Norway.*

Under the action of the special conditions of Eastern Norway a special breed of horses, known under the name of Gudbraundsdal (a valley in Central Norway), has been developed. These horses are raised by small farmers.

As for its origin, it is most probably the most northern branch of the western horse. Its appearance and anatomical structure resemble greatly those of the Danish Jutland and of the old Hessian horses. This agrees with the hypotheses as to the emigration of the human races. To the native breed of the Gudbrandsdal foreign blood was introduced during the 17th and 18th centuries and during the first half of the 19th. During the first two centuries it was especially Danish blood, chiefly due to stallions from the old stud of Friedriksborg. Later, in the first half of the 19th century, only a relatively small amount of foreign blood was introduced and that of very different origins. The importation of a Thoroughbred English stallion *Odin* is of special interest : its third generation included *Balder*, whose blood is at present diffused in all the Gudbrandsdal breed.

These horses are mostly bay or black ; about 4 per cent are chestnut and 1 per cent cream, while white is quite exceptional. Specially marked animals are relatively rare. The stature of the stallions taken as an average of 90 four-year-old horses born between 1900 and 1904 was 15 hands 1 inch. The mares are generally about 1 inch less.

The head is usually of average length, with a straight and broad forehead and well set ears. The neck is somewhat heavy for the size of the horse, and the head not very well set on. The chest, of average depth, has a good breadth ; the average girth of the above-mentioned 90 stallons was 74.02 inches. The withers are of a good shape. The back is inclined to be too long, but there are many specimens with a very handsome back. The ribs are well arched ; the rump is somewhat sloping and of average length and breadth and on the same level as the withers. The tail is set on high. The thighs are well proportioned as to length and are muscular. Altogether the muscular system is well formed. The legs are of average length. The hocks are large, well shaped and clean forming a proper angle. Occasionally turned in hocks occur. The cannon bones are of average length and clean, the pasterns short or medium and duly sloped, sometimes upright in stallions. The shoulder has a good position. The knee is well formed and strong ; flat and knock knees never occur. The cannon bones of the fore limb are also clean ; measured in the narrowest part, they averaged, in the 90 horses examined, 8.37 inches. The fore pasterns are of average length and duly sloped ; occasionally however defective positions are met with. The hoofs are of average size and of excellent quality; formerly they were often thin and flat owing to defective breeding, but now these defects have completely disappeared.

The action of these horses is regular, their trot long, but their gallop

not very elegant. It is a very suitable horse for the peasants, being hardy and thrifty as to food.

They are usually fed on hay, oats and rye bran ; in some places forest leaves are added but hay is always the principal food. Foals usually get about 11 lbs. a day during the first winter and 13 to 20 the next three winters. The daily ration of oats is from 2 to 3 ½ lbs. during the first winter ; in the succeeding winters very little oats are fed, 2 to 3 lbs. of rye bran being given instead.

Throughout the whole summer the young animals are turned out to graze and the brood mares are collected in droves of about 40, with one stallion, on the mountain pastures. These pastures belong to the State or to private owners. The latter let them to associations or possess a stallion of their own. In 1907 the national stallions gave 85 to 95 per cent. of fertile matings on the pastures and only 68 to 77 per cent. in the stables.

The State assistance consists of grants to associations for the purchase of stallions. These grants amount in some cases to £ 100 or £ 150. The State endeavours also to favour horse breeding by yearly shows, the most important of which is held at Lellehammer at the end of April or beginning of May; often as many as a hundred or a hundred and twenty stallions are collected here. The greater number are sold, fetching from £ 150 to £ 600. Most of them remain in Norway, but a good number go to Sweden and Russia and of late years some have been sent to Austria. Besides the Lillehammer show there are smaller national shows which are generally held in the autumn and in which mares are more in evidence. The mares which have had prizes or have been approved, obtain for five years the right to pasture free with the national stallions. The price of a draught horse varies between £ 35 and £ 44.

The Studbook is kept by the State. The first volume appeared in 1902, the fifth this year. Only the stallions that have been awarded prizes at the shows are entered. Exception may be made for a stallion getting good stock. Mares must be pure bred and must have already borne foals to a Gubrandsdal stallion. Some conditions concerning their outward conformation have also been added.

Among the measures for enccuraging horse breeding due to private initiative, the numerous trotting societies which organize matches during the winter must be noticed. Most of them are united in a large association " Det norske Traverselskab " (The Norwegian Trotting Association). At most races only pure bred Norwegian horses are allowed to compete.

The native breed of Western Norway is called the Fjord breed. Its origin is not completely known ; possibly it is a branch of the Celtic pony. The Fjord is a wiry horse, standing 14 to 15 hands 1 in. high. Its coat is almost always whitish, but of different shades ; from time to time also bays are met with. The head is small with a broad and straight forehead and small and very mobile ears. The neck is strong and the head well set on. The chest is deep and of average breadth. The withers are round, the back of average length, and the ribs well arched. The rump is slop-

ing and often not quite muscular enough. The tail is high set and free. The thighs are muscular and of satisfactory length; the hocks are always clean but their breadth is not always sufficient ; they are often much turned in and the angle they form is not always ample enough. The cannon bones are of average length, and clean ; the pasterns are short and set at a true angle. The shoulder is somewhat short and vertical ; the arm and forearm are of medium length, the latter being often poor in muscle. The knee is well formed ; the fore cannon bones are clean and well marked ; the fore pasterns are short and generally well formed, though sometimes owing to defective breeding knock-kneed animals are met with. The hoofs are small and of excellent quality. The step both walking and trotting is rather short, but the rapid action allows a great speed to be attained. These horses are very hardy and exceptionally enduring, and frequently travel 50 to 70 miles in a day.

SHEEP

835 – **Formation of a German Sheep-breeders' Union.** — *Zeitschrift für Schafzucht*, Part 7, pp. 145-150. Hanover, July 1914.

On the occasion of the German Agricultural Society's Show at Hanover this year a Union of German sheep-breeders was founded (Deutscher Schäfereiverband) with the object of uniting all the existing associations of sheep-breeders and individual breeders in an association for furthering sheep breeding in Germany.

GOATS

836 – **The Angora Goat.** — HELLER, L. L., in *U. S. Department of Agriculture, Farmer's Bulletin*, No. 573, pp. 1-16. Washington, April 27, 1914.

The value of the 1909 clip of mohair in the United States was $901 597, that is nearly four times as much as in 1899. The number of fleeces of mohair rose from 454 932 in 1899 to 1 682 912 in 1909. Of this latter number 1077 463 came from Texas, 155 980 from New Mexico and 141 588 from Oregon ; Arizona and California each contributed upwards of 100 000 and Missouri was the only other State with over 20 000. The average weight per fleece was 3.7 lbs. in Oregon and 1.85 lb. in Texas. In the latter State many Angora goats are shorn twice a year, for which reason the yield of mohair per head is undoubtedly above the census figure for the average weight per fleece in the State. Assuming that one third of the Texan Angoras are shorn twice it would appear that in the United States the total number of Angoras of shearing age was about one million.

During the last few years the breeding of these goats has increased in importance more than that of any other animal and it is now carried on in almost every one of the States. Conditions are especially favourable to this branch of animal husbandry in the North-West, in which brush is so abundant, and where the Angora goat contributes greatly to the control of forest fires by clearing brush lands. American Angoras have hitherto been exported mostly from California to South Africa, Canada, Alaska and recently also to Brazil and the Argentine Republic. The first Angoras introduced into the Union were mostly crossed with common goats in order to obtain a larger and hardier animal. The first and second crosses showed but little mohair and much kemp, and five or six crosses with pure

Angoras were necessary before a really superior animal was obtained. After the fifth cross the product could be considered as pure bred Angoras. The writer does not consider it advisable to cross with common goats in order to obtain Angora flocks. He considers it better to import good original animals and to keep them pure from other strains.

The Angora goats of the United States are generally pure white and horned. Their ears are either partially erect or drooping. Their bodies denote a good constitution ; they are symmetrically built, and with the exception of the inside of the upper part of the legs they are well coated with fleece. The demand is for fine quality, closely curled, very glossy fleeces and as nearly as possible free from kemp.

The price of mohair has of late years much increased in the Union owing to the many usages to which it is put (manufacture of plush, overcoats, wigs, etc.). The weight of fleece for American Angoras ranges between 2 and 12 lbs. The fleece of a one-year-old goat weighs 2 ½ lbs. Where the fleece is allowed to grow for 12 months the average length of staple is about 10 inches. The total weight of the fleeces produced in the United States in 1913 amounted to nearly 5000 000 lbs. The best of it comes from the North-Western States. The average cash production of a goat is, according to the North-West Angora Goat Association, $ 1.75 and with many as much as $ 2.25 per annum. Besides this considerable home production, the United States import, in round numbers, about 2 000 000 lbs. of mohair, which is on the average superior in quality to the American produce.

The loss of weight in washing of the home hair is about 12 to 15 per cent., rather greater than that of the imported article. The skins of Angora with the hair attached are sometimes tanned in the United States and are much used for rugs, carriage robes, etc. The flesh finds a ready market, especially in Kansas City. The average weight of the goats slaughtered there is about 68 lbs.

Shearing takes place from February to March and the second clip in September or October in the South-West, and from March to April in the rest of the country.

The most important Angora breeding associations are the " American Goat Breeders' Association ", the " National Mohair Growers' Association " and the " North-West Angora Goat Association ".

837 – **hicken Rearing.** (1) — *The Journal of the Board of Agriculture*, Vol. XX, No. 12, pp. 1049-1057. London, March 1914. POULTRY

The demonstration by Mr. F. G. Paynter of his system of producing table poultry, which was commenced in December 1912 at Haslington Hall, near Crewe, under the auspices of the Board of Agriculture and Fisheries in conjuction with the Cheshire County Council, came to an end in December last. An area of 4 acres in the middle of a newly formed small holdings colony was devoted to the demonstration, and from that point of view was particularly suitable for the purpose.

(1) See also No. 160, *B.* Feb. 1913. (*Ed.*).

During the whole time the demonstration lasted it was thrown open to the public. The Cheshire County Council appointed a temporary demonstrator whose chief duty it was to show people round and explain the system to them; the result of these and of other means to attract those for whose benefit the demonstration was designed, was that a large number of people visited Haslington Hall while the work was in progress.

Incubation was commenced in the beginning of December 1912 and terminated by the middle of the following July. Three incubators holding 340 eggs, and one holding 390 eggs were used. All the eggs were bought from various sources. The result of the incubation was as follows:

Number of eggs bought	9 897
» » broken	294
» » infertile	1 690
» » not hatched	3 885
» of chicks obtained	4 028
Percentage hatched on total number of eggs incubated	41
» of chickens hatched after allowing for broken and infertile eggs	51
Average cost of eggs per chicken hatched	4½*d*

The proportion of chickens hatched to eggs purchased was never more than 54 per cent. This relatively small proportion was partly due to shaking in transit and it is probable that better results would have been obtained if reliable eggs could have been purchased locally.

From the incubators the chickens were removed to the brooders, and when they were seven weeks old they were removed to larger wire runs (100 × 10 yards) and housed in so-called "Sussex arks," where they stayed until about 16 weeks old, when they were ready for sale. The plan adopted by Mr. Paynter for disposing of them was to contract beforehand for the sale of the whole of his output to a poulterer near London, at fixed prices varying from 3*s* 9*d* in April to 2*s* 6*d* in September.

The number, values and weights of the chickens sold were as follows:

Number of birds sold	3 471
Weight	13 968 lbs.
Average weight of chickens when sold	4.024 lbs.
Value of birds sold	£496 8*s* 1*d*
Average price per pound	8½*d*

The following is a summary of the food consumed and of its cost:

		£	*s*	*d*
3 437 lb.	Chick feed	24	10	1
7 071 »	Biscuit meal	40	5	8
711 »	Oatmeal	5	3	1
389 »	Rice	3	2	3
1 899 »	Bran	6	18	9
2 862 »	Meat and fish meal	24	9	3
4 475 »	Barley meal	19	18	4
21 210 »	Sharps	77	0	7
18 985 »	Wheat with 10 per cent. of maize	68	3	5
		£ 269	17	5
Grit		5	10	0
	Total food bill	£ 275	7	5

The profit and loss account shows a net profit of £55 1*s* 2*d*. This is relatively small, but it must be borne in mind that the work was seriously interfered with by the reception of so large a number of visitors, and that the outlay was valued somewhat high. In practice a small holder would save on several items, such as part of the work, and his profits would be higher.

During the current year Mr. Paynter is conducting a similar demonstration in Cambridgeshire.

838 – **Experiments on Egg Laying in Different Breeds of Poultry.** — (Eighty-fourth Report of the Royal Veterinary and Agricultural College Laboratory for Agricultural Experiments at Copenhagen). *Communicated to the International Institute of Agriculture by the Correspondent for Denmark.*

The object of these experiments was : 1) to determine the difference in the yield of eggs of various breeds of poultry ; 2) to throw light on several conditions of fertility of the eggs and on the colour of the shells.

1. Experiments were carried on for three years on the egg laying of the following breeds : White Leghorn, Brown Leghorn, Barred Plymouth Rock, White Wyandotte, Black Minorca and Houdan. The Leghorns took first place for both number and total weight of the eggs. While the average number of eggs laid by the Leghorns during the three years was about 100, the Plymouth Rocks laid about 70, the White Wyandottes about 60, the Black Minorcas about 90 and the Houdans about 80. The figures for the last three breeds, however, are only approximative as in several of the pens disease was rife.

In comparative trials of Brown Leghorns, Nassaus and Orpingtons, the latter gave the highest yields, followed by the Leghorns, the Nassaus coming last. Considering only one-year-old hens the Nassaus and especially the Orpingtons laid more eggs than the Leghorns, but if the two to three-year-old hens be included in the amount the result is somewhat more favourable to the Leghorns. The good result with Orpingtons is to be attributed not only to relatively better laying, but especially to a more uniform distribution over the individual months in the year.

2. As to the most profitable age for egg laying it has not been possible to determine any sure rule. Most hens lay the greatest number of eggs during the first or second year, but there were some that produced more in the third year. In general it may be considered that the greatest number of eggs is obtained during the first year.

3. As for summer and winter laying there is no large difference between Plymouth Rocks and Leghorns, the former laying a slightly greater percentage of their eggs during the winter months than the latter. It has also been observed that the older hens lay a smaller percentage of their eggs during the winter months than the younger ones.

4. The weight of individual eggs was greater for Minorcas and Leghorns than for White Wyandottes and Houdans. It seems as if the weight of the eggs increased with the age of the hen.

5. Repeated weighing has shown that the weight of the birds increases with age, but only up to the end of the second year, when they are

fully grown. Within each year the weight of the body seems to follow certain laws, according to which it grows from autumn to spring and sinks again during spring and summer. This is especially noticeable in good layers, the body weight of which decreases to a greater extent than that of the bad layers during the spring months when egg laying is more active.

6. From the observations made, it appears that broodiness, which is more frequent among Plymouth Rocks than among Leghorns, is most pronounced in the best layers.

7. The above experiments have further shown that 16 days after mating the hens still lay fertile eggs. When mating is repeated after a period of more than 16 days, the first fertile egg is generally laid three days, and sometimes four days later.

It has not been possible to influence the colour of the egg shell by pairing a cock of a breed which has yellow or brown eggs with a hen of another breed that lays white eggs, or viceversa. The breed of the hen is alone responsible for the colour of the egg shell.

The number of eggs laid, as given in paragraph 1, will be thought somewhat low and there are doubtless many flocks of poultry in Denmark that lay more eggs. One of the reasons of the relatively low number of eggs obtained during these experiments is that for the sake of other tests, the poor layers, which a private breeder would soon get rid of, had also to be kept. Thus, for instance while one Plymouth Rock laid in the three years 200, 177 and 182 eggs, another one laid during the same time only 2,5 and 4 eggs respectively.

839 – **Contribution to the Study of Sericulture in Indo-China.** — BUI-QUANG-CHIÈU, in *Bulletin économique de l'Indo-Chine*, Year 16, Nos. 101 and 102, pp. 165-178 and 376-401. Hanoï-Haïphong, March, April, May, June 1913.

Silkworm breeding was introduced into Annam from China about the tenth century. It was encouraged by the Annamese emperors, especially Gia-Long and Minh-Mang, and soon became a flourishing industry in the peninsula, continuing in this condition up to 1851, after which date its progress ceased. The French administration, notwithstanding many efforts, has not yet succeeded in giving sericulture in Indo-China the development which the good natural conditions of the country would allow; on the contrary the industry has even declined. This state of things is due to deep-seated economic and social causes:

1. The intense literary culture, which induces the educated Annamese to take up administrative careers (as mandarins) and to neglect agriculture and industry.

2. The improvements in the European cotton industry, which provides Indo-China with cheap and good cotton goods that have in many cases taken the place of the old silk tissues.

3. The natives were formerly taxed, by the mandarin administration, arbitrarily and according to their apparent wealth; consequently they did not dare to use the fine Chinese silks which would have marked them out to the rapacity of the mandarins. Under the French administration they have abandoned the Indo-Chinese silks in favour of the Chinese

fabrics and of late years they have made much use of Lyons and Japanese silks, notwithstanding their higher prices.

4. The neglect of the cultivation of mulberries for that of rice, the latter being easier to sell than cocoons ; besides which there is no doubt that the diseases to which silkworms are liable have discouraged many native breeders.

At the time of the French conquest, according to Dr. TURC, great centres of production existed in the huyen of Kien-duong (now Cai-fây, Cai-bé and Rach-gâm) in the province of Dinh-tuong (Mytho) ; the districts of Sadee and Bentré, which sent their produce to the great market of Vinh-long ; in the east of Cochin-China the districts of Baria, Long-thanh and Thu-dau-môt ; at present next to nothing remains of the great plantations. In 1870 French spinning mills were started at Cholon, but they had to be abandoned on account of the fall in prices on the Lyons market. In 1883 the Government nominated a mission for the reorganization of sericulture and founded a silkworm breeding establishment at Cholon, in which an attempt was made to improve the native worms by crossing with foreign breeds. The results were bad, and the same was the case with all attempts at crossing with Chinese or Japanese worms. M. VIEIL believes that these failures are due to the fact that the native worms, being more slender, can eliminate water vapour better than the French, Chinese, or Japanese worms, which are fatter and consequently present a smaller evaporating skin surface in comparison to their weight ; he does not think that there has been, as has often been asserted, any degeneration of the Indo-Chinese worms. He believes also that breeders have launched thoughtlessly into the system of crossing, which, if it had been preceded by study and systematic experiments on the best breeds more akin to the native breeds, might have yielded far better results.

In 1905 a silk specialist was entrusted by the Governor-General with a mission which resulted in the formation of a French company ; this entered into an agreement with Indo-China for the selection and free distribution of silkworm eggs to the natives by means of subscription. The old spinning mills of Nam-dinh were resumed and the breeding farm of Phu-lang-thuong, which was managed by M. VIEIL, was attached to it. The latter came to the conclusion, from the experiments he made, that it was better to keep to the improvement of the Annamese breeds and to teach the natives how to rear the worms. At the same time reeling basins of European pattern were simplified for the natives. These basins, the price of which is not above 12 shillings, were given free of charge to the Annamese; a Lyonnese employee of the Agricultural Service, a silk specialist, was instructed to teach them the way of using them.

All these efforts are beginning to bear fruit and already the quality of the silk exported to the mother country is improving. Indo-China has not followed the rapid progress of Japan; even Corea and Siam have developed their sericulture. Indo-China, which has a population well adapted to this kind of industry and which might make use of the scientific results

acquired by the mother country, will also see a great increase in its silk production.

Geographical distribution of sericulture in Indo-China.

The whole of Indo-China raises silk, but the delta districts take the lead.

Tonking. — The provinces in which silkworms are reared on a large scale are the following, arranged according to their importance: Nam-dinh, Thai-binh, Bac-ninh, Phu-lien, Phu-lang-thuong, Phu-ly, Hung-yen, Hanoï and Son-tay. Mulberries are grown in the alluvial lands, on the banks of rivers (Red river, Song-thai-binh, Song-thuong, etc.). Reeling and weaving are practised especially at Nam-dinh and Thai-binh. There are at Phu-lien flourishing plantations and important native weaving factories (Do-son, Kien-an).

Annam. — Sericulture is practised in all the provinces, but in the south (Khánh-hoá, Phú-yén) and in the north (Thánh-hoa, Quang-binh) it has rather declined; it has markedly progressed in the centre in Binh-dinh and Quang-nam. At Phu-phong, in the province of Binh-dinh, there is a great industrial spinning and weaving centre. Silk raising has declined in the province of Thua-thien, the only centres being the huyen of Phu-vang and the district of Thien-mô, which are not very important.

Cochin-China. — The silk industry is more widely spread but in a more backward state than in Tonking. There are no European factories and the attempt made twenty years ago by commander COLBERT DE TURGIS at Tan-chau to establish a station for killing the pupae in the cocoons failed. There are, however, about 3700 acres of mulberry plantations and all the silk industry is in the hands of small native growers and is at the same level as it was two thousand years ago. There are also some important centres of mulberry growing and silkworm rearing in the province of Chau-dôe, especially in the mountainous district about Thai-son, Tu-tê, and Triton, where the inhabitants are chiefly Cambodians. The island of Cù-lao-ba and the Malay canton of Châu-giang form an important spinning and weaving centre. In the province of Long-xuyên, the mulberry belt extends from Cu-lao-giêng to the Ongchuong canal, including the village of Long-diên and others, as well as some islands round Cu-lao-giêng. The village of Cho-tu-chên-sai is the most important centre of this district (and perhaps of the whole of Cochin-China), exporting its silks (generally dyed black) especially into the provinces of Cân-tho, Rach-giá and Bac-lieu. The province of Sadec, formerly renowned for its worked silks called "hang-không-tren," has to day only La-vung as centre, and this is of no great importance. The course of the Mékong has then to be followed as far as Bentré (Batri and Mocay) before the mulberry is again met with. A kind of taffeta called "lua", which formerly had a certain reputation, is woven there. In the provinces of Bac-lieu, Soc-trang and Tra-vinh all the silk industry is in the hands of Cambodians; the Cambodian centres of Tra-kha, Tra-cu (Tra-vinh), Vinh-châu, Vinh-phuoc (Bac-lieu), Lai-tâm, Var-

thap, Phuoc-lai and Yên-tâp (Soc-trang) cultivate mulberries, breed worms and weave the silk.

Cambodia.— All the banks of the Mékong between Tân-châu and Pnom-penh are planted with mulberries in the parts that are inundated every year. On the borders of Cochin-China is the silk centre of Banam, in the province of Prey-veng, which has raised worms from the eggs of the Station of Takeo (Pnom-penh).

The Upper Mékong seems to have a certain future before it from the sericultural point of view ; silk raising is much scattered ; the resources of Laos are imperfectly known, and unfortunately the attempts made in Tonking and Cochin-China have not been extended to this locality.

The breeds of silkworms in Indo-China.

They are polyvoltine, generally with yellow cocoons, exceptionally dirty white. It requires 18 to 20 lbs. of fresh coccons to produce 1 lb. of raw silk reeled after the European fashion. The complete evolution of the worms lasts from 42 to 46 days: 10 for hatching the eggs, 20 to 30 according to the weather for the growth of the worms and from 10 to 11 for spinning and pupation.

Annamese breeders distinguish the following four breeds : Bâu-bi, Bau-diêu, Ken-se and Tâm-soc ; their characters however are badly defined. The writer gives some of them. The Tonking breeds are generally of larger size.

Silkworm rearing.

The writer studies the native systems in order to draw the attention of European breeders who would improve their defective details.

The breeders themselves attend to the egg-laying ; the unit adopted is the " cup " (the quantity of eggs laid by 4 or 5 fertilized female moths put together under a cup). No selection is practised. Native breeders generally undertake the raising of a number of worms too great for their available space. Their yields are not remarkable, 22 to 28 lbs. of cocoons for 100 layings, and often less.

Incubation does not require any special care. Hibernation is not practised. The eggs have only to be protected against red ants. Annamese breeders remove the newly hatched worms only in the afternoon or the day after the first eggs are hatched, which has the effect of obliging those that are hatched first to fast until the late ones come out. The young worms are swept off with a feather, many being injured in the process.

Moulting lasts 24 hours ; the longest of the stages, the last, is of eight days. The food of the worms is frequently very imperfectly chopped and may contain fragments of wood which wound many worms. The worms are set to spin their cocoons on hurdles which yield up to 11 lbs. of cocoons each.

The breeder does not usually spin the silk, but sells his cocoons to a spinner at current prices minus a rebate of 1*d* per 11 lbs. in favour of the

spinner. When the worms have thriven well and produced cocoons suitable for reproduction they fetch as much as twice the price paid for cocoons for spinning.

The defects of native breeders are the following. They hatch out a quantity of eggs much superior to their means (this applies specially to the Cochin-Chinese) ; being short of hands they hurry roughly through the various operations, causing injury to the worms ; this injury is then attributed to occult powers, which the breeders seek to appease by superstitious practices instead of improving their methods of breeding. The most elementary rules of hygiene are unknown ; the diseased worms are thrown about anywhere and become new sources of infection.

Diseases and enemies of silkworms in Indo-China. — The most widespread diseases are : " pébrine, " " grasserie ", " flacherie " and " muscardine " ; a fly called " con-lang " also causes a good deal of damage.

Pébrine, called in Tonking " tam-gai ", causes much less havoc in Indo-China than in France. It is beginning to decrease owing to the free distribution of selected eggs ; the sale of unselected eggs should be forbidden and more lectures for the natives should be given.

Flacherie, called " tam-lung " in Tonking and " tam-di-duor " in Cochin-China, appears especially in the last stages.

Some worms cannot digest their food and die without exhaling the characteristic odour of flacherie ; under the microscope they show bacilli in moniliform strings.

Another disease, called "atam-kuong " in Tonking, causes the worm to stretch out, and the third to the sixth ring to blacken ; the last rings become transparent ; the worm then dies and exhales a fetid odour.

Grasserie appears under various aspects, according to which it bears various names ; it is especially frequent in moist and stormy weather. It causes much havoc and often destroys whole batches of worms.

Muscardine is rather rare in Indo-China and is not much dreaded by native breeders.

The " red disease " is not very serious ; it attacks the moths, which die after having laid a limited number of eggs.

The fly " con-lang " deposits its eggs on the worms and secretes at the same time a corrosive liquid which attacks the skin and makes an opening in it, through which the egg penetrates into the worm where the larva feeds on the tissues of its host, reducing them to pulp ; one worm can carry as many as 6 or 7 larvae. When the latter are fully developed they issue from the body of the worm by a large opening and enter into the crevices of the floor, where they pupate. The pupa is at first light brown, then black and it develops in about 12 days. In order to guard against this insect, breeders protect the worms during the first stages by a mosquito curtain. In Tonking the windows are closed by a fine bamboo network. This fly is in its turn parasitized by *Encyrtus sericophilus* (Hymenoptera), the study of which has been the object of a communication to the Académie des Sciences of Paris.

Another fly, called " rui dâ ", which resembles a wasp, attacks the worms when placed on the hurdles to spin their cocoons ; its sting is instantaneously fatal, but the damage it does is insignificant.

The silk industry.

Though the industry is established throughout the country it is still in a very backward condition. Spinning in the European fashion is not practised by the natives ; there are in Indo-China only three filatures, two belonging to Frenchmen at Nam-dinh (Tonking) and at Phuphong (Annam); the third at Thai-binh (Tonking) belongs to a native company. All three possess improved plant.

The Annamese systems of spinning produce a raw silk unacceptable on European markets.

The unit of cocoons in the filature is the " cân " of 11 lbs.; the unit of weight for the cocoon trade in Tonking is a bundle of 600 " sapeks " (" quan-tiên "), weighing 3.25 lbs., but considered in the French trade as 3.3 lbs. The unit for raw silk in skeins is 10 taels, or 9.25 lbs.

The thread of the cocoon that is formed in damp weather often breaks on spinning ; it yields a fluffy silk of inferior quality and is used to adulterate spun silk for export.

The floss is sold to the Chinese, who export it to Cholon, whence it appears a certain quantity is sent to France to the silk by-product factories. It is estimated that in Indo-China the floss pays the labour and the firing in the spinning mills.

The raw silk obtained in Cochin-China is useless in Europe; the " to-lua " or first quality is utilized by the local looms, while the " to-be " quality is exported by the Malays to Bangkok.

Annam silk is exported to Hongkong and Singapore. Tonking silk, which has improved thanks to the combined efforts of the Administration and of the Nam-dinh mills, finds its way in increasing quantities to France, but four-fifths of it still goes to Hongkong.

The native production is very low and is not sufficient for present demands ; consequently it does not seek other outlets. Neverthless the efforts made by the neighbourng countries, especially Siam, the Philippines and Corea, to extend their production, render considerable efforts in the same direction necessary on the part of Indo-China. But there are still great obstacles to be overcome : 1) the lack of a technical direction sufficiently endowed by the administration ; 2) the want of European factories in Cochin-China and in Cambodia ; 3) the ignorance of the natives in general and especially of the spinners, and their lack of initiative ; 4) the want of capital, interest on which is almost always 50 per cent. and upwards, often reaching 100 per cent.

The first steps towards progress must be made by the administrative authorities. The following would be useful measures :

1. Promoting in Cochin-China and in Cambodia the formation of native societies for reeling silk, under the technical direction of French officials. Such societies have given excellent results in Tonking.

2. Providing the natives with improved spinning apparatus, as has already been done in Tonking, and granting prizes either to the spinners or to the exporters according to experience.

3. Teaching the Annamese to reel off a fixed number of threads with knolled ends, replacing bamboo reels by aluminium ones, increasing the twist and adjusting better the motion of the combs. A great deal of tact and a full knowledge of the industry are necessary in the officials who are to induce the natives to adopt these measures, which would considerably increase the value of Indo-Chinese silks even on Asiatic markets and procure profitable sales for raw silks.

4. The awarding of prizes in money and honours by the Government.

Native weaving. — Silk is woven everywhere in Indo-China, but the processes are not equally developed in all centres; Tonking and Annam are more advanced than Lower Cochin-China.

In Tonking weaving is especially prosperous in the provinces of Nam-dinh, Thai-binh and Kiên-an. Dô-son is renowned for its silks, a kind of taffeta called "lua"; in the province of Hâ-dóng the village of La-ca is distinguished for its gauze called "the La-ca". With the exception of the gauzes, taffetas, serges and satins which compete with the same Chinese woven goods, the natives turn to China for their finest garments. Of all Indo-Chinese countries, Cochin-China is the one which consumes the greatest quantity of Chinese silks.

In Annam, fine satins, gauzes and crapes are woven at Binh-dinh. The importation into France of Binh-dinh crapes continues to increase.

In Cochin-China weaving is limited to plain silks and some taffetas with very small patterns. The most important looms of Cochin-China and Cambodia are those of the orphanage of Cu-lao-giêng, managed by the Sisters of the Apostolic Mission : here taffetas are made with patterns of Cambodian or Siamese style, 28 and 32 inches wide, as well as crapes (foulards and shawls) with French hand embroidery. Tissues of the same kind are manufactured by the Malay cantons of Xom-châ-và (or Xom-châu-giang) over against Châu-doc. The same Malays excel in the manufacture of "sampots" called "chàng hung" (a special kind of taffeta).

Indo-Chinese mulberries : their diseases and pests.

The mulberry cultivated in Indo-China is the white mulberry. There are many varieties of it, which have not yet been studied from the botanical or the nutritive point of view. The native varieties may be reduced to four : dâu-tau", with leaves cordate, thin, entire or lightly serrate ; "dâu-phung", with trifid leaves ; "dâu-se", small cordate leaves ; "dâu-thù-du" (papaw mulberry), with leaves deeply divided, somewhat like those of the papaw.

Enemies. — In the mountainous region of Châu-doc, where the mulberries are grown as standards, occurs a longicorn beetle, the larva of which

bores holes in the trunk ; this insect has no special name among the Annamese ; the perfect insect gnaws rings in the bark of the branches.

The writer found in 1908 in the province of Ben-co some mulberries suffering from the attacks of an aphis lodged in the underground parts of the tree between the bark and the wood : the bark dries and falls off the parts attacked.

Termites cause serious damage to the mulberries planted on the dunes, called " giông ".

The mulberries on the banks of the Mékong at Tân-châu are attacked every year in the dry season by a fungoid disease which curls up the leaves and dries them, rendering them useless. The trunks of the trees attacked show swellings and become brittle. The natives do not do anything to combat the disease, which disappears as soon as the rains come.

840 – **Fraudulent Introduction of Dead Lobsters in the Parcels sent to Market by Certain Breeders.** — JUGEAT in *L'Hygiène de la viande et du lait*, Year 8, No. 7, pp. 341-343. Paris, July 10, 1914. FISH BREEDING.

The wholesale death of lobsters caused in the breeding basins by the variation in the salt content of the water due to accidental infiltration of fresh water, causes considerable losses to the breeders, a certain number of whom do not hesitate to mix these dead lobsters with the live ones in the parcels they send to market, especially to Paris, where the writer on one occasion seized no less than 295 lbs. of them. The flesh of these animals is of a very inferior quality; it is lean, dry, friable and tasteless; it turns to pulp on being cooked and putrefies rapidly. It is therefore important to recognize such lobsters at once. Their characters are as follows :

1. *External characters.* — The muscles are completely relaxed, the membranes of the articulations are thick, dull and whitish (instead of being thin, shiny and transparent) and turn black in a few hours.

2. *Internal characters.* — The tissues are soft and swollen with water; if a membrane be cut, water flows from the aperture, which never occurs when the animal is taken alive from the breeding basin.

FARM ENGINEERING.

841 – **Trial of Machine Ploughing in Rice Fields.** — TARCHETTI, A., in *Il Giornale di Risicoltura*, Year IV, Nos. 5, 7 and 8, pp. 65-80, 103-107 and 122-128. Vercelli, March 15, April 15 and 30, 1914. AGRICULTURAL MACHINERY AND IMPLEMENTS

The Italian Experiment Station for Rice Growing at Vercelli organized a trial of machine ploughing in ricefields which took place on March 30, 1914, at Sig. Eusebio Saviolo's estate at Sali Vercellese, near Vercelli. Upwards of 64 acres of land were placed at the disposal of the Committee ; the fields were very uniform and large, so that the average length of the furrows was about 1000 feet, and the plot assigned to each machine about 7 ½ acres.

The following eight machines were admitted to the competition :

A. Motor-hauled ploughs — BARONCELLI, of Ravenna, Italy ; FERRETTI GOGGIA, of Tortona, Italy.

B. Self-contained motor ploughs — PAVESI TOLOTTI, of Milan, Italy; STOCK of Berlin, Prussia.

C. Cable-hauled ploughs — CASALI, of Suzzara, Italy; SANTACHIARA of Reggio Emilia, Italy; VIOLATI-TESCARA, of Ariano Polesine, Italy.

D. Rotary digger — V. MEYENBURG, of Bâle, Switzerland.

1. *Baroncelli's motor.* — 24 H P. (effective), 800 revolutions per minute, total weight 3960 lbs. — Has been somewhat modified to meet the special requirements of rice fields; the diameters of the wheels have been increased, as well as the breadth of their tyres.

2. *Ferretti-Goggi motor.* — 24 to 30 effective H P., 500 revolutions per minute, total weight 9 900 lbs. — Its wheels are on the Lefebvre or Holt Caterpillar system; that is they run on an endless chain of steel plates.

3. *Pavesi and Tolotti's "moto-aratrice"* or self-contained plough. — 16 to 20 effective H P., 700 to 800 revolutions per minute, total weight 4180 lbs. — In this machine the steering wheel has been enlarged and all the tyres have been widened.

4. *Stocke's motor plough.* — 42 to 50 HP, 700 revolutions, total weight 11 000 lbs. — This machine has also been somewhat modified in view of the special work before it.

The three cable-hauled machines (5, 6 and 7) are all on Howard's single-engine system, with a separate windlass bearing two drums and a cable running round the field, though they differ in the construction of the windlasses and in other particulars.

5. *Casali's apparatus* was presented with a 13 effective HP, heavy oil motor, built by the National Gas Engine Co. (Ashton); the two-wheeled windlass truck, with 1600 to 2000 feet of wire cable, weighs 3 550 lbs.

6. *Santachiara's* windlass was presented with a Garret 12 effective HP steam engine; it is mounted on a four-wheeled truck and weighs with 1600 feet of wire cable, 3960 lbs.

7. *Violati-Tescara's* outfit was entered with two different motors: one is a heavy oil Mietz and Weiss 25 effective HP motor, and the other an electric three-phase motor of the same horse-power.

8. *Meyenburg's rotary digger.* — 25 effective HP, 1000 revolutions per minute; the drum bearing the diggers makes 180 revolutions per minute. Its total weight is 4400 lbs. and its breadth of work 6 ½ feet.

Of the above outfits, Nos. 3, 4 and 8 require only one man to work them, while Nos. 1 and 2 require two men and Nos. 6 and 7 require four.

All the machines entered finished off the work allotted to them, except the electric motor of No. 7, which did not arrive in time for the trial of March 30.

The points given by each of the 19 judges were 70, distributed as follows:

20	for quality of the work done
20	» cost
10	» ease and safety of handling and transporting
10	» regularity of work of motor and suitableness to other purposes
10	» construction and solidity.
70	

The following were the awards :

Group of cable-hauled outfits:

CASALI	1 222 points
VIOLATI-TESCARA	1 215 »
SANTACHIARA	1 102 »

Group of direct-traction outfits:

BARONCELLI	1 170 points
STOCK	1 108 »
PAVESI-TOLOTTI	1 051 »
FERRETTI-GOGGI	960 »

842 – **Experience with Motor Plou hs in the Cultivation of Moor Soil.** — *Protokoll der 72 Sitzung der Central-Moor-Commission vom* 15-17 *Dezember* 1913, pp. 164-202 + 21 figs. Berlin.

In the 72nd sitting of the Central Moor Commission, four members, Dr. Ramm, Herr Volckmann of Kienberg, Herr Schmig of Etzin and Prof. Falke of Leipzig, reported upon their practical experience with motor ploughs. The earliest experiments were those begun in 1907 at Wiesmoor ; electric machines were used, as the steam ploughs then existing seemed too heavy. The division of the land to be worked into fields is shown in the accompanying figure. The arrangement of the electric line at right angles to the roads requires long cables, but on the other hand it saves expense on the permanent lines and on the roads. When each machine is provided with 2300 feet of cable, cross-roads are required only every 4 600 feet. With steam ploughing the arrangement is the same except that the cross roads with power lines are not necessary.

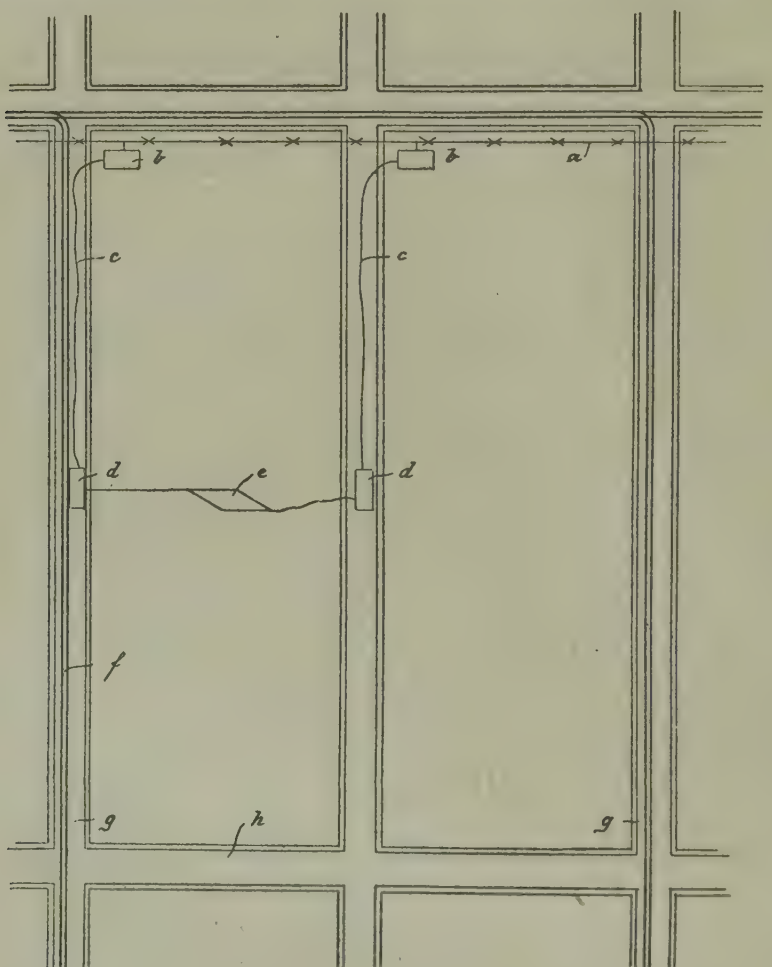
After several trials, satisfactory results have been obtained. Ploughing by electricity costs from 5 *s* 11 *d* to 6 *s* 8 *d* per acre ; a steam engine propelling itself along the moor roads and burning peat costs 5 *s* 7 ½ *d* to 6 *s* 2 *d* per acre. The lower figures represent the cost with favourable weather and with a long duration of work.

Thanks to the experience gained the windlass (anchor) trucks were constructed in such a way that they did not require a road to be made for them. In order to prevent their being dragged sideways by the powerful strains put upon them they are fitted with large hook-like attachments which press against the side of the ditch on the edge of the field and slide along it like a sledge when the truck moves forward.

As regards the ploughshare, experiments are now being made in order to ascertain whether a share which turns the furrow-slice completely over (which has been found suitable in fens) is advisable for these moors.

Experiments with cable-hauled disk-harrows have been successful and those with rollers also. For roller work, with the exception of that on the rough ploughed land, motor rollers are now used and have proved successful. They can be made heavier at will and are so arranged that they can haul a manure spreader at the same time.

Arrangement of moor land for electric ploughing at Wiesmoor.



EXPLANATION.

a. Electric line.
b. Transformer truck.
c. Cable.
d. Electric windlass.
e. Plough.
f. Portable field railway.
g. Sanded road.
h. Road not sanded.

Each plot measures 550 × 1540 yds.

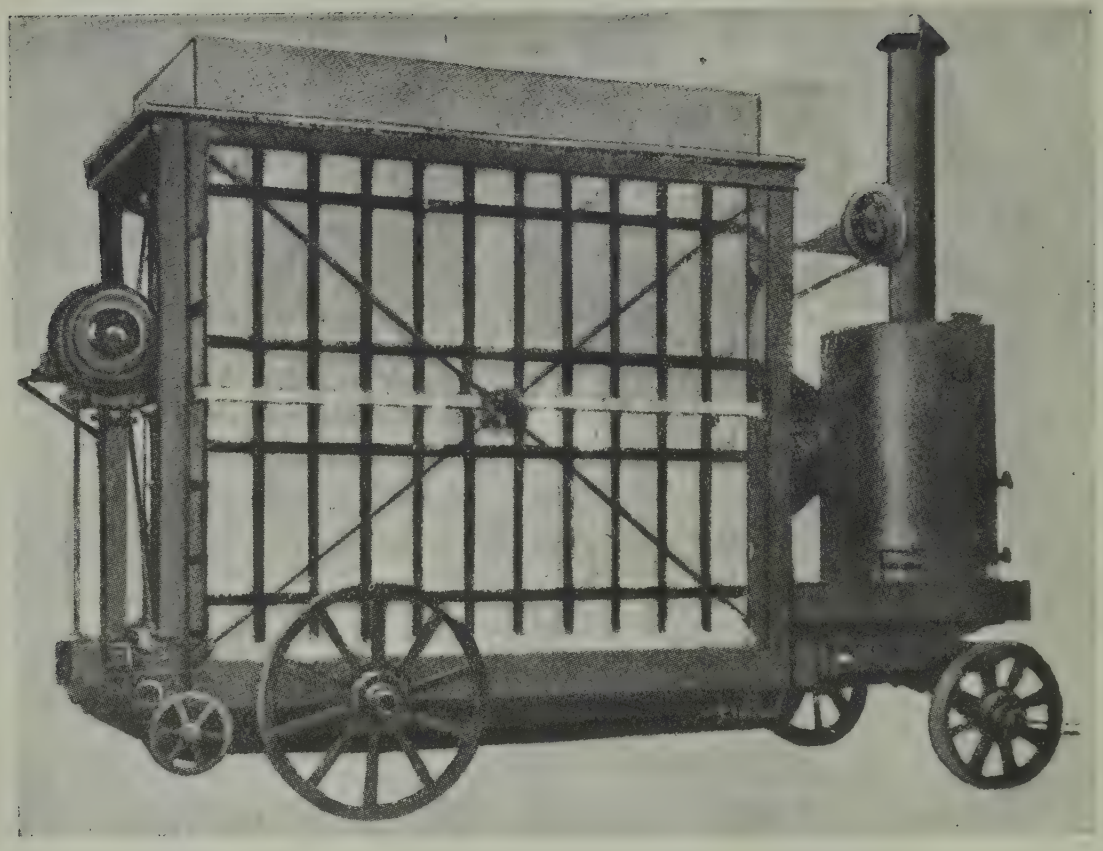


Fig. 1. — Side wiew of paddy esiccator.

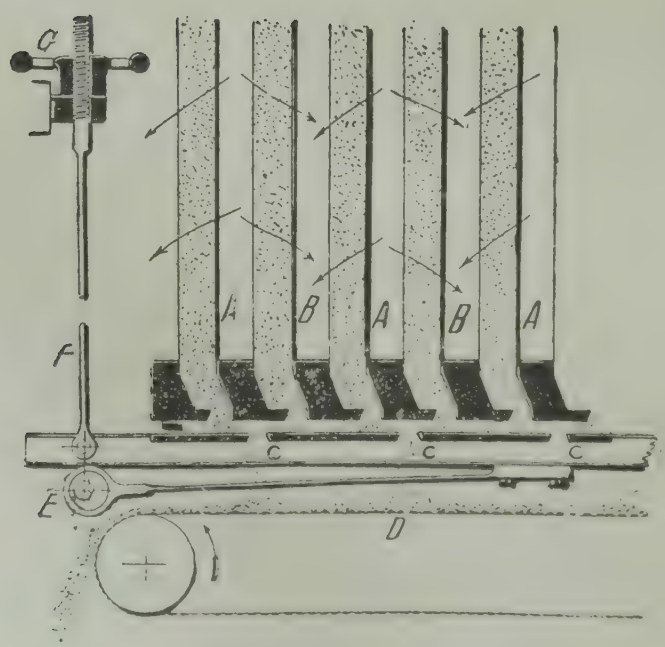


Fig. 2. — Partial longitudinal vertical section of paddy esiccator.

At Kienberg a two-engine Ergomobil plough and a rotary digger have given good results.

At Etzin a two-engine benzine motor outfit has proved very suitable for deep soft moor soil. The 24 HP motors ploughed 0.62 acre per working hour. On dry hard soil, however, the motors are not powerful enough ; they should be at least 30 HP.

At Hartenholm the motor plough has been successful on waste land that had been once broken up, but it is not yet known how it would behave on the rough virgin moor.

On the whole the reports show that the efforts for the construction of motor ploughs suitable for moors have yielded good results.

843 – **A New Esiccator for Paddy.** — TARCHETT I., A., in *Il Giornale di Risicoltura*, Year IV, No. 6, pp. 88-90. Vercelli, March 30, 1914.

A new type of portable paddy esiccator has been designed and built by Geminardi, Guidetti & Co., mechanical engineers, of Vercelli, Italy. A side view of the machine, which is simple and strong, is shown in fig. 1, and part of its longitudinal section in fig. 2.

The paddy is fed from the top into a series of vertical parallel chambers about 2 ½ inches wide and separated from each other by air spaces, A, B, of the same width. The hot air from the generator first enters into the spaces A; as these are closed at the top it is forced to pass through the rice into the spaces B, whence it escapes into the atmosphere. The temperature of the air is regulated by suitable slides in the hot air generator and in the fan.

The dried paddy issues through a slot in the bottom of the vertical chambers and falls onto the horizontal plane, CCC, which moves forwards and backwards by means of an excentric and connecting rod, and thence onto a canvas carrier which delivers it at one extremity of the machine.

The amount of rice passed through the esiccator is regulated by changing the speed of the excentric and by raising or lowering the plane C by means of the screws in G.

The vertical chambers in which the rice is dried are formed by light iron frames on which wire netting is stretched and which slide easily into grooves in the framework of the esiccator.

The machine can hold about 112 cwt. of paddy.

844 – **Artificial Hay-Drying.** — *The Country Gentleman*, Vol. LXXIX, No. 22, p. 1033. Philadelphia, May 30, 1914.

In many countries a great deal of hay is more or less spoiled or even completely lost every year by the heavy dews and rains of the haying season.

Several years ago T. P. Russell, a Southern Missouri farmer, wrote to the United States Department of Agriculture to ask whether the artificial curing of hay was not an economic possibility. The office of Farm Management began to investigate the question at his farm from 1907 to 1913 and now the problem has been solved.

Hay can be cured at a profit, be it green, half cured or soaked with rain-or dew. Freshly cut grass covered with dew or rain and containing 70 to 80 per cent. of moisture can be cured in 20 to 40 minutes into hay containing 10 per cent. of moisture and this hay can be baled immediately on leaving the kiln and will keep indefinitely.

The above-mentioned office has erected an experimental plant for the curing of hay; it is practically a barn heated by a steam boiler. At one end of the barn is a feeder chute into which the green or wet hay is fed as it comes from the fields. As it enters the chute it is caught on slowly moving belts which carry it round and round the heated interior of the barn, finally bringing it out at the other end cured and ready for baling or for storing loose.

The existing plant is worked at a steam gauge pressure of 80 or 90 lbs., which gives a maximum temperature of 260° F. (126 °C.) at the bottom of the drier, and 223° F. (106 °C.) at the top.

The hay it turns out is superior in colour to field-cured hay and has a very sweet aroma, and in repeated tests the animals before which both kinds of hay were placed ate the former first and often refused the latter.

Analysis shows that the drier-cured hay differs little from the uncured grass and is superior to field-cured hay. The protein content, on a water-free basis, is 19.15 for uncured grass, 18.70 for drier-cured hay and 13.71 for field-cured hay. This difference is partly due to larger leaf content.

Mr. Mc Clure, the official of the Farm Management Office, gives the following estimate for a hay-drying plant capable of turning out 1 ½ tons or more cured hay per hour:

Excavation	$ 104.00
Kiln superstructure, walls, roof, settings for conveyors, etc.	$ 2 160.92
Doors, hinges, guide plates	$ 233.75
Engine shed	$ 300.00
Painting and glazing	$ 281.20
Conveyors, drive, fans, turbine, elevator, regulator, castings boiler and other machinery	$ 10 422.08
Contingencies	$ 2 500.00
Total	$ 16 001.95

Of course no farmer of ordinary means can afford to invest such a sum, but large owners and cooperative associations could easily do so.

As for the cost of artificially curing hay, at the experimental plant in S. Missouri it was found that a ton of cured hay required 1.3 tons of coal. According to other experiments, however, it is asserted that in a 1500-ton drier the fuel requirements would be reduced to 0.6 ton of coal to one of cured hay. The total cost is given in table I.

Considering the advantage of assuring the regular output of crops regardless of weather, and the increased nutritive value of the hay produced by artificial means, it is safe to say that though artificial curing will not take the place of sun or field drying where and when good haying weather prevails, it will enable the grower so to cure his entire crop that it will all grade as " choice " and thus command the highest prices.

TABLE I. — *Cost of artificial hay drying.*

	When a ton of coal costs		
	2.50	3.50	4.50
Fuel cost based on 0.6 ton of coal per ton of cured hay . . . . . $	1.50	2.10	2.70
Total labour, interest, maintenance, etc. . . . . $	2.97	2.97	2.97
Total cost of curing from standing grass to baled hay in barn . . . . . $	4.47	5.07	5.67
Less cost of curing one ton in field . . . . . $	2.60	2.60	2.60
$	1.87	2.47	3.07

Besides the above investigations, the Office of Farm Management has examined the possibilities of a plant operated by direct heat. The drier consists of a sheet-iron box, 6 by 3 by 3 feet, equipped with a sliding pipe containing damper and thermometer connecting this firebox to the firebox of an ordinary steam boiler. It was fitted with woven wire trays for holding hay and a fan.

With this equipment the drier could be operated up to 700° F. (370° C.), and with an air circulation through the drier up to 4 500 feet a minute. Table II gives the results of experiments with this direct heat drier.

TABLE II.

Velocity of fan discharge	Temperature		Time required to cure	Protein
	Front (1)	Rear (1)		
ft.	deg. F.	deg. F.	minutes	per cent.
3 600	600	250	8	18.81
4 200	640	260	5	17.62
900	450	220	15	17.50
650	400	200	15	19.50
800	400	250	15	18.69
800	350	225	20	17.61
4 200	600	415	15	24.69
2 800	320	200	10	19.75
1 400	320	215	20	20.38
Cured in sun at ordinary temperature (2)				21.31

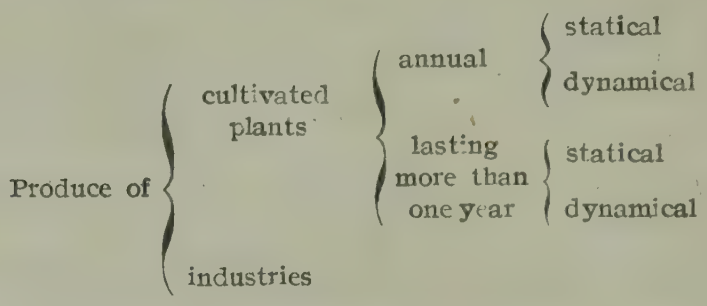
(1) "Front" where the hot air first comes into contact with the hay ; "Rear" where the air has passed through the hay and is ready to be discharged from the drier by the fan.

(2) This sample was carefully cured without the loss of any leaves and therefore does not truly represent ordinary field-cured hay.

RURAL ECONOMICS.

845 – **Statistical Research on Farm Produce.** — MARENGHI, ERNESTO. Extract from the "*Giornale degli Economisti e Rivista di Statistica*", Part I, pp. 1-31 + 2 tables. — *Atheneum*. Rome, 1914.

As an introduction to his research, the writer draws up the following scheme of farm produce:



I. — THE PRODUCE OF CULTIVATED PLANTS.

A: The group of statical annual produce. — To this belongs the yield of herbaceous crops, as well as that of woody plants submitted to yearly cultivation, that is subdivided into as many groups of the same age as there are years in the whole cycle of production.

This produce is *statical* on condition that the systems of cropping do not vary. The relative succession of these products may acquire increasing *dynamical* character only if the systems of cropping improve or deteriorate, or if new enemies or modifications of physical environment appear; but apart from these factors, the annual range of these products represented by a Cartesian diagram gives rise to a broken line, the general trend of which is parallel to the axis of the abscissae. The phenomenon of production of these crops belongs therefore to the group of those which are expressed quantitatively with sufficient approximation by the arithmetical means of a sufficient number of cases. In practice it is suggested to extend the same observation to a period of 10 to 12 years, which is justified also by theory. The writer, however, observes that in periods of very rapid intensification of agricultural production it is well to restrict oneself to the comparison of a still more limited number of terms, because to every successive stage of progress for a given crop a different *normal production* corresponds. The idea of normal production is nothing absolute in itself, as it can only refer to sharply defined conditions of cropping, case by case.

B: Group of *yearly dynamical produce.* — To this belongs the produce of ordinary woody plants not subjected to yearly management. This produce varies from time to time, not only through accidental causes like the statical, but also as a function of the age of the plantations, giving rise to very characteristic dynamical chronological series which serve for the construction of the law of production concerned. The *normal curve of production* of woody plants varies from case to case as a function of many factors: species of trees, system of management etc. One of the

fundamental aims of economic statistics is that of investigating these curves by suitably applied methodical observation.

With this object the writer proposes to replace *observations in time* which require long periods of time, by *observations in space*, by recording the actual yields of woody plants in similar regions, separately for the plants of each age.

When this observation has been continued for a certain number of years, for instance 10 or 12, there will be sufficient material to determine the normal curve of production, assuming as the normal produce of the n^{th} year of age the average of the produce ascertained on trees of that age during the various years of observation. The series of the normal yields thus obtained is the numerical expression of the normal curve which is sought.

The writer notes that by the same process, in the short space of one year the data sufficient to draw a *gross curve of coexistent yield* may be collected, and that this may lead to the normal curve when the ratio between the actual unit yield of the year under observation and the average of the region under investigation is known. Thus, representing the equation of the gross curve by

$$y = f(x)$$

the normal one will be:

$$y = K f(x),$$

in which K is the ratio defined above. The writer obtains similar results (on the hypothesis that the methods of management do not vary sensibly) with the data of a *gross series* of *successive yields*, the perfecting of which may be obtained by arithmetical, algebraical or graphical means. The first is the simplest of all: it consists in substituting for every term of the series the arithmetical means of the three, five, seven, etc., terms of which it is the middle one (Wittstein's method). The *algebraical* process consists essentially in replacing the gross curve by a simpler one which it is assumed corresponds to the real law of the phenomena. The problem is solved by causing a curve of a certain order to pass through certain points under determined conditions according to the method of interpolations. The *geometrical* or *graphical* method consists in representing the gross series by a Cartesian diagram and in interpolating in it a curve which approaches the same series and then determining according to scale the values of the ordinates corresponding to the theoretical curve.

The writer then discusses the fragmentary series and the process of interpolation based on the hypothesis, which corresponds with sufficient approximation to reality, that the yield of woody plants varies approximately according to geometric progression provided the intervals considered be not too long and the accidental oscillations be neglected.

This process of interpolation finds its analytical expression in the following formula, which allows the missing data of the series to be interpolated:

$$y = K \alpha \rho^x.$$

in which :

y = average yield of the plant at the age of $\alpha + x$

$K\alpha$ = average yield of the plant at the age of α.

ρ = constant ratio of variation

x = independent variable quantity which gives the age of the plant in any year of the interval considered, supposed to be of n years.

It follows that setting $K\sim$ for yield at the end of the same, the equation

$$K\,\alpha\,\rho^{n-1} = K\sim$$

is obtained, from which the following results :

$$\rho = \sqrt[n-1]{\frac{K\sim}{K\,\alpha}}$$

This process of interpolation thus consists in the analytical representation of the production of woody plants bearing annual produce, not by means of a single curve (in which case the approximation would be too wide), but with several and successive branches of curves connected with each other. These may be considered as the expression of as many empirical laws of the phenomenon that is investigated, each of them being, with sufficient approximation, with certain limits of age of the same plants.

The exactness and the value of the process of interpolation may be experimentally checked when suitable statistical data are available.

The writer notes in this connection the low trustworthiness of the statistical data existing as to the curves of production of woody plants bearing yearly produce, and the necessity of systematic observations of the same in order to collect valuable material for the solution of the most varied economic problems.

C : The group of polyannual produce. — To this belongs the principal production of woods not under regular rotation. These woods are either high forest, in which case the cycle of the formation of the product coincides with that of the plant, or they are coppice, and then it is a submultiple of the latter. The distinction is of a certain importance for these statistical researches, since high forest gives rise to a *chronological series of statistical produce*, whilst coppices — at least in some cases — gives rise to *dynamic series*.

The data that are necessary and sufficient to individualise the fundamental production of woods are two : the *physical quantity* (discriminated if necessary in selected groups or otherwise) and the *extent of the corresponding cycles of elaboration*, which are not fixed as they are for the annual products, but are susceptible of being varied within certain limits with the object of realizing a maximum profit, other conditions being equal. Thus the curve of the increment of wood in forest plants is characterized by the progressive decrease of the rate of increment; during this progressive diminution the limit of profitableness is reached when the rate of wood increment expressed in money coincides with the rate of interest.

D: The indices of variability of crops and the ways of determining them. A crop, other conditions being equal, presents less risk the steadier its productivity, which is expressed by suitable figures called *indices of variability*. One of the indices most frequently used for statistical series is obtained by dividing the square of the mean deviation of the mean of the fields during the various years of observation from the arithmetical mean of the whole period by this latter mean.

The writer notes that these indices of variability are not liable to generalization but are strictly connected to the special conditions of environment and proves by means of suitable examples that the range of the yield of the same crop varies within very wide limits from one locality to another as a function of many circumstances.

II. THE PRODUCTS OF AGRICULTURAL INDUSTRIES WHICH RESULT IN A MORE OR LESS ELABORATE TRANSFORMATION OF CROPS.

The ratio (at least approximately) between them is *constant* in some cases and *variable* in others. It is constant, for instance, in the transformation of grapes, olives etc., but variable in that of forage crops. The statistical investigations to be carried out in the first case are not many, it being enough to determine the coefficient of *yield per unit*. If this ratio is variable the *law of variation* has to be sought according to the systems of methodological statistics.

The writer restricts himself to a consideration of the production of milk and of meat.

The production of milk varies — for every individual kind of cow — according to many factors: breed, age, diet, stage of lactation, etc. In order to get the principal characters of the process, a sufficient number of animals have to be subjected to experiment and they have to be grouped according to age, diet, or other factor, in agreement with the problem to be solved. Supposing the factor considered be age, the average individual yield of the animals under observation will have to be determined for each class of age. The series of average yields obtained will give the curve of the facts as functions of the age; this can be further simplified by transforming the individual terms in index numbers, that is by making the first term equal to 100 or 1000 and reducing the others in proportion.

The writer reports some data collected on a group of Simmental cows and notes that the general trend of the curve of the annual individual mean shows a certain analogy to what is observed in the production of woody plants bearing fruit yearly.

The writer examines similarly the influence of the time that has elapsed from the beginning of the lactation on the yield of milk, and from the individual chronological series obtained from a Swiss cow belonging to the Perugia Agricultural Institute he finds the corresponding normal curve by means of a suitable process of equalizing. The production of milk in the months following calving diminishes very nearly in geometrical

proportion and consequently the normal curves may be represented analytically by functions of the type of:

$$y = p_1 \rho^{x-1}$$

in which
y = milk yield of any month x.
p_1 = milk yield of the first month after the birth of the calf.
ρ = a constant ratio to be determineed either by the method of the least squares or, simpler still and with sufficient approximation, by taking the average of the actual ratios which are obtained by dividing every term by the one which precedes it.

In a special table the writer compares the actual series of a group of Swiss cows with the theoretical series and notes that the agreement between the two is more than satisfactory. Even on the hypothesis that the actual series should present some gaps, the ratio ρ of variations could be equally determined (though less exactly) and the analytical formula could be found and it would among other things allow the whole series to be reconstructed and the total corresponding yearly production to be determined.

Submitting to a similar process some data relating to the production of flesh, the writer notes that the series of the increments of weight per unit in young and in adult animals in course of being fattened gives rise to a descending curve which turns its convexity to the axis of abscissae and which may be represented — as in the case of milk yield — by an equation of the type of:

$$y = p \rho^x$$

The development of animals by weight follows the economic law of increasing production. A gradually diminishing increment by weight corresponds to an increasing consumption of fodder. Admitting as a fairly probable hypothesis that the rations of animals are homogeneous for every group and directly proportional to their weight, the writer infers that the above equation represents also the action of the said law as regards the production of flesh.

846 – **The Position of Non-Breeding Dairy Farms in Modern Agriculture.** — BRINKMANN, THEODOR, in *Fühlings Landwirtschaftliche Zeitung*, Year 63, Part 13, pp. 433-449. Stuttgart, July 1, 1914.

The subject of dairy farms which do not breed their cows, especially in their importance from the point of view of social economy, is much discussed at present. The writer studies the problem exclusively from the point of view of rural economy and proposes to answer the two following questions:

1. Is it justifiable from the economic point of view to keep dairy cows without breeding them, and if so under what general conditions is this to be preferred to dairy farming with breeding?

2. What are the effects of the present changes in the conditions of the industry and of agricultural production upon the profitableness of the

two rival systems? Do they affect both systems equally or do they favour one more than the other?

I. — Both systems are intended to utilize to the utmost the fodder produced on the farm itself, and this especially by transforming it into milk. The non-breeding dairy farm can, with the same quantity of fodder, produce much larger quantities of milk than the breeding dairy farm, because the former keeps only milk-producing animals; further it possesses another advantage from the point of view of the utilization of milk in that while in the breeding farm a part of the milk produced is consumed by the calves, the other type can utilize at will all the milk that it produces and may besides regulate its production to suit the demands of the best possible utilization. These advantages ensure the non-breeding dairy farm gross returns in money which are fairly high in comparison to the quantity of fodder to be utilized. This, however, cannot be obtained without a relatively high cost of production, caused especially by the loss, which in general is considerable, entailed by the purchase and sale of cows, by the necessarily intensive feeding and great consumption of concentrated foods, by the relatively high price of labour and by the considerable risk attendant upon the continual purchase of strange cows.

From these considerations it is evident that the conditions which justify the existence of non-breeding dairy farms are present when it is possible to utilize the large quantities of milk produced in the farm in such a way that the receipts balance the high cost of production. If the price of the milk increases gradually, a point must be reached at which the advantages given by the high gross yield are superior to the disadvantages caused by the high cost of production. This is clearly shown by Table I (1), in which the yield in milk and the gross returns in cash for the different prices of milk have been calculated, then the cost of keeping the cattle, that of the concentrated foods and lastly the difference between gross returns and outlay, that is the net returns obtained by utilizing the fodder at the different prices of milk, referring all the figures to 100 kilos (220 lbs.) of starch value of the fodder produced in the farm itself. These calculations have been made for three different groups of farms: 1) dairy farms which do not breed their cows; 2) dairy farms which breed a part of their young stock; 3) dairy farms which breed all their stock.

The division of labour which exists under these two systems of dairy farming is thus perfectly justified as an economic necessity, as a consequence of the variations, from one farm to another, of the net returns obtained by the utilization of milk. After all the problem of the non-breeding dairy farm is only a question of the price of milk. Nevertheless the conclusion cannot be drawn that a limit of fixed profitableness, true under all conditions, can be established between the two systems; on the contrary, the deciding limit in the price of milk must be determined separately in each case, as it depends upon the special conditions of each farm:

(1) This table is taken from FUNK: Die landwirtschaftlichen Betriebsverhältnisse der bäuerlichen Milchwirtschaften im Havelland. — *Arbeiten der D. L. G.*, Part 169.

TABLE I. — 100 *kg.* (220 *lbs.*) *of starch value of*

	Number of farms	I. Supply					
		Gallons	Gross receipts in cash when the price of milk per gallon is:				
			d 6.44	*d* 7.48	*d* 8.56	*d* 9.60	*d* 10.7
			s d	*s d*	*s d*	*s d*	*s*
In dairy farms which do not breed	23	50.25	26 9 3/4	31 3 1/4	35 9	40 2 3/4	44 8
In mixed dairy farms. . . .	21	45.50	24 4	28 4 3/4	32 5 1/2	36 6	40 6
In breeding dairy farms. . .	13	34.75	19 2	22 4 3/4	25 6 3/4	28 9	31 11

its size, the quality and quantity of the fodder to be utilized, the requirements as to the production of farmyard manure, the professional capacity of the farmer and the amount of his capital. In general it may be said that the conditions to warrant the division between the two systems exist only where the milk is sold as such.

II. — It is evident that in the course of time the limits of the areas occupied by each system shift in consequence of the changes which occur in the conditions of profitableness. The expenses due to certain factors of production, chiefly those which weigh heavily on farms that do not breed, have increased considerably of late years. This is especially the case with concentrated foods and the losses caused by restocking the stables, and with the price of labour.

On comparing the average prices of the two periods 1901-03 and 1909-12, an increase of 14 per cent. is found in the price of earthnut cake, 12 per cent. in cotton seed, 17 per cent. in coconut cake, 18 per cent. in wheat bran and 23 per cent. in brewer's grains. The increase in the price of labour and the decrease in the quality of the work done are notorious. The increase of the cost of concentrated foods and of other expenses weighs also on the budget of breeders, but not so heavily as on the non-breeding dairies, which spend almost twice as much as the former on concentrated foods (see Table). Furthermore there has been, since 1900, a rapid rise in the prices of milch-cows, amounting to £ 5 to £ 6 per head in the Rhine Province. Though the increase in the price of milch-cows has been partly balanced by the increase in the prices of fat cattle, this rise in the price of cattle weakens considerably the position of non-breeding dairies, for in the competition between the two systems the increase in prices injures the one and benefits the other, since the high prices paid by the non-breeding dairies are an advantage to the breeders.

It is undeniable that of late years there has been a considerable increase in the sale price of milk, but according to the writer the consequent increase of the gross returns has not been sufficient to counterbalance the

odder produced on the farm (hay, straw, mangolds, etc.)

II. Require the following expenses						III. Yield a net profit when the price of milk per gallon is:									
for labour, interest, amortizement of working capital, depreciation of stock			for purchase of concentrated foods			Total			d 6.44		d 7.48		d 8.56		d 9.60		d 10.72	
s	d	per gal. d	s	d	per gal. d	s	d	per gal. d	s	d	s	d	s	d	s	d	s	d
	$3\frac{1}{4}$	1.96	13	$7\frac{1}{2}$	3.28	21	$10\frac{3}{4}$	5.24	4	11	9	$4\frac{1}{2}$	13	$8\frac{1}{4}$	18	4	22	$9\frac{1}{2}$
	$3\frac{1}{2}$	1.92	10	$6\frac{1}{2}$	2.80	17	10	4.72	6	6	10	$6\frac{3}{4}$	14	$7\frac{1}{2}$	18	8	22	$8\frac{3}{4}$
	$4\frac{3}{4}$	2.16	5	$3\frac{1}{4}$	1.76	11	8	3.92	7	6	10	$8\frac{3}{4}$	13	$9\frac{3}{4}$	17	1	20	$3\frac{1}{2}$

increased cost of production. And if such were really the case the considerably increased chances of profit in breeding caused of late by the conditions of the market would always signify a sensible loss for non-breeding dairy farms. The fact is that during the last ten years the profits of cattle breeding farms have considerably increased, both absolutely and also relatively to those of non-breeding dairy farms; it is this latter fact which settles the matter, because the question of the profitableness of a branch or a system of farming does not depend upon this branch or system paying its expenses absolutely, but rather upon its bringing in more profit than any other branch which might replace it.

The weakening of the position of non-breeding dairy farms will be still better understood when it is considered that the technique and the improvement in the means of communication and other factors tend always more to abolish the monopoly in the supply of fresh milk which formerly belonged to the districts of production nearest to the markets. Many and various circumstances concur in rendering easier the supply of milk to the centres of consumption, such as the facilitations offered by the railways for the carriage of milk, the better preservation of fresh milk due to systematic treatment, the ease with which milk can be obtained from distant districts thanks to a series of organizations of producers, traders and sometimes of consumers; all these factors and others also act in the same sense, favouring the offer of milk and opposing the increase of its sale price, increasing the utilization price in new districts of production and decentralizing the production of fresh milk. The creation of new districts of supply tends to equalize the local prices of milk and the intensity of production in the districts of supply. Those that are situated at greater distances may adopt a more intensive system; all of them, however, approach an average line in their degree of intensity. Thus, the farms which are intermediate between the non-breeding ones and those which breed all their stock are especially favoured by recent developments and will increase in importance.

847 – **The Organization of Team Work according to the Results of Bookkeeping and to Net Returns.** — OSTERMAYER, ADOLF, in *Mitteilungen der landwirtschaftlichen Lehrkanzeln der k. k. Hochschule für Bodenkultur in Wien*, Vol. II, Part 3, pp. 411-431. Vienna, 1914.

The expense for the work done by draught animals is a large item in the total working expenses of a farm. Calculated on the results of bookkeeping they have been found to be as follows, when expressed as percentages of the total cost of production.

For cereals	in the plains . . .	11.0 %
	in the mountains .	17.2 »
For beets	in the plains . . .	24.9 »
	in the mountains .	28.2 »
For potatoes . . .	in the plains . . .	19.9 »
	in the mountains .	18.3 »
For hay	in the plains . . .	13.5 »
	in the mountains .	11.4 »

The range of the amount of these expenses exerts a great influence upon the net returns of the whole farm, as the writer proves with the aid of the books of 61 Moravian peasant farms. The average net return of these 61 farms is 19*s* 11 ½*d* per acre and corresponds to a rate of interest of 3.5 per cent. on the average capital of £28 4*s* 0½*d* per acre. This result has been obtained at the average cost of 2*s* 11*d* per day's work per animal and an average number of 4.66 days per acre, which brings the expenses of team work to 13*s* 8*d* per acre. With the help of these figures the writer calculates the net returns which correspond to the range in the cost of the day's work of the animals from 2*s* 1*d* to 3*s* 11½*d*.

	s	*d*		£	*s*	*d*	
When the work day costs	2	1	the net returns are	1	3	8 ½	per acre
» » »	2	6 ½	» » »	1	1	8	»
» » »	2	9 ½	» » »	1	0	5	»
» » »	3	2 ½	» » »		18	6	»
» » »	3	5	» » »		17	7	»
» » »	3	10	» » »		15	9	»
» » »	3	11 ½	» » »		15	2	»

Among the components of the cost of the work of draught animals, the cost of feed and wages exert a decisive influence, as may be seen from Table I, in which the total cost of the day's work of an animal has been divided into its component parts for three groups of farms, each of them presenting different amounts for the keep of their draught animals.

TABLE I. — *Composition of day's work of teams.*

Group	Average cost of a day's work	Daily outlay					Partial items in percentage of total outlay				Actual number of work days out of 100 available days
		Fodder	Labour	Amortizement and interest	Sundries	Total	Fodder	Labour	Amortizement and interest	Sundries	
	s d	*s d*	*s d*	*s d*	*s d*	*s d*	%	%	%	%	
I	2 3½	– 9	– 6	– ¼	– 1½	1 4¾	53.6	34.6	2.4	9.4	60.9
II	2 8	– 10½	– 2	– 1	– 1	1 2½	70.7	14.1	6.9	8.3	45.8
III	3 8	– 11½	– 5½	– 1	– 1	1 7	58.9	28.6	5.8	6.7	43.1
Average . .	2 11	– 10½	– 4½	– 1	– 1½	1 5½	60.8	26.1	5.1	8.0	46.5

Table I shows also that the cost of an animal's day's work does not always follow the cost of keep, because it depends also to a great extent upon the degree of effective utilization of the draught animals. Consequently this utilization has a great influence on the net returns, as may be seen in Table II, which shows the average net returns of several groups of farms arranged according to the degree of effective utilization of their teams.

TABLE II. — *Average net returns of groups of farms arranged according to the degree of effective utilization of their draught animals.*

Group	Small farms		Medium farms		Large farms	
	Degree of effective utilization	Net returns per acre	Degree of effective utilization	Net returns per acre	Degree of effective utilization	Net returns per acre
		£ *s d*		£ *s d*		£ *s d*
I	98.3	1 15 4	72.5	2 10 7	62.2	1 14 0
II	76.3	18 7	54.7	1 13 10	48.5	1 13 6
III	51.9	9 10	36.8	1 4 1	41.5	1 8 0

The same results are obtained by grouping the farms according to their net returns and calculating for the groups thus formed the average effective utilization of the draught animals, as in Table III.

TABLE III. — *Average utilization of draught animals by groups of farms arranged according to their net returns.*

Group	Small farms		Medium farms		Large farms	
	Net returns per acre	Degree of effective utilization	Net returns per acre	Degree of effective utilization	Net returns per acre	Degree of effective utilization
	£ s d	%	£ s d	%	£ s d	%
I	2 5 11	95.8	3 17 3	58.7	3 8 3	51.0
II	0 18 8	82.2	1 12 6	54.0	1 0 11	55.0
III	—0 7 1	70.9	—0 4 4	53.1	0 2 0	47.1

With one exception the net returns diminish with the degree of effective utilization, so that the most intense and regular utilization of the available draught animals is a fundamental factor for obtaining satisfactory net returns.

Nevertheless in organising the work of draught animals there is another problem also to be solved, namely that of suiting the animals to the needs of the farm, not only according to their number but also according to the different kinds of draught animals. As such, horses, oxen and cows may be considered, and they differ from each other by their individual characters, pace, intelligence, facility of being driven, etc., and by the cost of their keep. The writer calculates the influence of the size of the farm, of its situation, of the intensity of farming, of the intensity of hoed crops and the outer and inner means of communication, on the conditions of the work of the draught animals in the 61 Moravian peasant farms, and illustrates by means of diagrams the employement and the degree of utilization of the different kinds of draught animals in the farms, divided into two groups according to the amount of the net returns. The results of these calculations are set forth in Table IV.

In small farms the great use of the cow as a draught animal is very advantageous ; a too liberal use of horses and oxen causes a decrease in the net returns; on the other hand in large farms the work of horses is very advisable and it should be completed by that of oxen only to a limited extent, because large farms require team work more continuously than small farms and horses are more suitable than cattle, and especially cows, to continued work.

In well organized mountain farms the work of horses is much employed, to a lesser degree that of oxen, while cows are only used as a temporary reserve during the busiest time in the summer. The increase of the number of oxen and the simultaneous reduction in the number of horses causes a decrease of net returns. Similarly in the plains the best utilizatilon of the draught animals is obtained only by the supplementary use of the labour of oxen, though the number of horses is by far superior to that of the oxen. The organization of the team work in intensive farms with high net returns resembles very closely that of well managed plain farms,

TABLE IV. — *Work-days of horses, oxen and cows under various conditions.*

			Small farms, less than 24.7 acres	Large farms, over 74.1 acres	Plain	Mountain	Working expenses per acre: Intensive, over £5 1s 2½d	Working expenses per acre: Extensive, under £5 1s 2½d	Hoed crops: Intensive, over 12 %	Hoed crops: Extensive, under 12 %	Distance from market: under 3.11 miles	Distance from market: over 4.66 miles	Rounded property and fields near farm	Scattered property and fields far from farm
High net returns	Horse days	available	545	4 760	5 439	2 640	5 545	1 401	5 174	2 106	1 793	5 093	4 061	4 652
		used	401	2 477	2 997	1 679	3 160	946	2 791	1 339	1 179	2 966	2 314	2 977
	Ox days	available	0	533	800	274	640	1 372	457	593	946	355	0	0
		used	0	158	238	103	190	414	136	224	355	165	0	0
	Cow days	available (1)	2 130	0	0	637	152	856	108	976	961	84	249	0
		used (1)	2 130	0	0	637	152	856	108	976	961	84	249	0
Low net returns	Horse days	available	1 772	3 581	5 605	2 558	4 751	3 356	3 546	3 191	2 506	2 517	1 579	2 928
		used	742	1 724	2 975	1 164	1 985	1 472	1 360	1 143	1 596	1 332	799	1 240
	Ox days	available	1 797	0	0	1 409	531	1 175	442	2 097	0	1 839	1 908	243
		used	854	0	0	661	359	545	299	997	0	883	785	83
	Cow days	available (1)	1 859	2	0	782	886	0	1 364	909	750	492	922	640
		used (1)	1 859	2	0	782	886	0	1 364	909	750	492	922	640

(1) As the cows' keep is not to be debited to the labour account except when the cows actually work, the available cow days have been put equal in number to those effectively utilized.

because the good climatic conditions and the fertile plain land lead to an intensification of farming. It is a mistake to make much use of cows as draught animals in intensive farms and it reduces the net returns. Nearly the same results are obtained by grouping the farms according to the intensity of the hoed crops.

It follows that the horse may be considered as the draught animal *par excellence* for intensive farms. On the other hand well managed farms under extensive cultivation show a remarkably small use of the horse and a notable preference for the work of cattle, both oxen and cows, and it is especially in farms with not much land under hoed crops that the work of cows is prevalent. Errors of organization in this case are the prevailing use of horses, which are insufficiently utilized, and the neglect of cows, which are the most suitable draught animals for extensive farming.

Farms near the markets can utilize cattle to a greater extent than those situated further off, notwithstanding the constant tendency towards the intensification of culture, and without diminishing their net returns; they are even forced to do so in order to utilize regularly their draught animals. Indeed the necessity of a good deal of carriage is a factor of an equal distribution of animal labour, inasmuch as this transport work may generally be performed at the times in which work is slack on the farm. This explains the great amount of horse labour in farms at a distance from markets and yet yielding considerable incomes.

It is the same with the distance between the fields and between these and the farm. A very small distance or none at all favours the intensification of culture and leads to the prevalent work of horses, completed by that of oxen and cows, with a view to equalizing the distribution of the work. The use of horses becomes still more prevalent in those farms in which the fields are wide apart and distant from the farm itself. This group of farms is the only one which still gives high returns while using only horses as draught animals; this is explained by the time saved by the quick pace of the horses in covering the above distances. In these conditions the use of cows would be an error.

From what has been said it appears manifestly that in organizing the work of the animals of a farm the capability and the characters of the different draught animals employed are the basis on which they are to be chosen. It is only by combining and completing reciprocally the work of the various animals in harmony with local conditions that it can best be utilized with the object of keeping the cost of production low and of obtaining high net returns.

The writer demonstrates the truth of the above by means of diagrams containing for the previously mentioned 61 farms, divided into two groups according to the amounts of net returns, the curves of the horse, ox and cow days, per week and per 100 acres of area of cultivated land. These curves are compared with each other and with the line representing the annual average of the work days, expressed in horse-days per week, in the farms yielding high net returns.

848 – **Investigations into the Profitableness of Fen Cultivation.** —FRECKMANN, W., and SABOTTA, in *Landwirtschaftliche Jahrbücher*, Vol. XLVI, Part 2, pp. 275-326. Berlin, 1914.

The writers endeavour to solve the problem of the profitableness of fen cultivation on the basis of the experience collected during ten years of work at the Neu Hammerstein Moor Experiment Station, with the help of the data contained in the literature on the subject. In the first place they try to determine the capital that is necessary for such undertakings and then they discuss the ratio between the purchase price of the bare fen and the capital required for improvements. They estimate the capital for buildings for all kinds of farming at the average figure of 25 per cent. of the total value of the land.

In the calculation of the profitableness of the regularly installed fen farm, there is no question of ascertaining the amount of expense for each unit of the original acreage, but of determining the extent of utilisable areas after the improvements have been carried out, as well as the cost of purchase and improvement of the unit of productive surface of fen in order to know the interest that it bears. Draining by means of open ditches means a considerable loss of area. The writers calculate the amount of this loss, and the capital represented by the Neu-Hammerstein fen farm, as follows :

Unsanded meadows.

	£	s	d
A) *Drainage by open ditches :*			
1. Preparatory work per acre	1	19	8
2. Drainage by open ditches	1	6	9
3. Work on the slopes and sowing		6	4
4. For the main drainage canal		3	2
5. For roads		1	11
Total per acre of original area	£3	17	10
For one acre of cultivable surface the cost of cultivating is as follows :			
1. Preparatory work, draining, main drain, and roads per acre of cultivable land, with a loss of 2.25 per cent. or $\frac{£3.17.0}{0.9775}$	3	19	9
2. Ploughing (8 inches) including hoeing	1	11	9
3. Disk-harrowing		19	0
4. Manuring :			
a) 6.37 cwt. kainit, 4.78 cwt. basic slag, including haulage	1	1	1
b) Mixing, carting and spreading.		2	4
5. Sowing :			
a) Rolling		1	2
b) 9 ½ lb. clover and grass seeds	1	7	11
c) Sowing			9
d) Rolling with light roller		1	2
Total	£9	4	11
Purchase value £11 18*s* per acre of bare fen : cost of cultivable area $\frac{£11\ 18s}{0.9775}$	12	3	6
Cost of buildings per acre	7	18	9
Total cost per acre of cultivable area	£29	7	4

B) *Drainage by fascines:*			
1. Preliminary work	1	19	8
2. Drainage by fascines	2	7	8
3. Main drainage canal		3	2
4. Roads		1	11
Total per acre	£4	12	5
5. Ploughing and hoeing	1	11	9
6. Disk-harrowing		19	0
7. Manures, carting and spreading	1	3	6
8. Sowing	1	11	1
Total	£9	17	9
Purchase value	11	18	0
Buildings	7	18	9
Total	£29	14	6

In this way the writers calculate the cost of purchase and improvements per unit of area of the meadows and arable land and come to the following results (Table I).

In preparing sanded fen cultivation it is generally much more advantageous to bring the sand from outside rather than to excavate it from the subsoil of the fen, because a layer of 5 inches taken from the subsoil would cause an average loss of area of 20 per cent.; the consequent increase of the cost of installation per acre of cultivable surface would equal the cost of getting the sand from a distance of 2 660 yards, so that up to this distance this means must be preferred. There is the further reason that the subsoil sand is often exceedingly fine and harmful.

An argument in favour of underground drainage is that it avoids loss of surface. Unless special technical reasons, such as the depth and special nature of the fen, or the constitution of the subsoil, or the impossibility of obtaining pipes or fascines at reasonable prices and of conveying them to the fen (often lacking in roads), oblige the open drain to be resorted to, this form of drainage should be avoided.

Besides the financial reasons it must also be borne in mind that open drains in winter do not carry off a sufficient quantity of water, and further that the vegetation on the edges and slopes of the ditches affords protection to animals and plants injurious to crops.

In establishing the cost of producing the several crops the writers include in the general farm expenses: the interest on the instruments of production (live and dead stock and stores), all expenses for management and supervision, for bookkeeping taxes, dues, repairs of buildings and roads, wear and tear of buildings and plant, etc. For the individual crops the following percentage of the gross yield is considered as general expenses: for meadows 12 per cent., for pastures 10 per cent., and for field crops 15 per cent.

In the calculation of the crop returns the writers use figures that are somewhat below the real average yields at Neu Hammerstein, as in Table II.

TABLE I. — *Cost of land and improvements on fen soil (per acre).*

Description of system of cultivation	1 Value of improvement	2 Purchase price of land	3 Value of buildings	4 Capital (2 + 3)	5 Total value (1 + 2 + 3)	6 Share of cost of improvement in % of total value	7 Ratio of purchase price of land to value of improvement
	£ s d	£ s d	£ s d	£ s d	£ s d		
Unsanded meadows, ditch drainage . . .	9 5 1	12 3 6	7 18 9	20 2 3	29 7 4	31.52	100 : 76.02
Unsanded meadows, fascine drainage . . .	9 17 9	11 18 0	7 18 9	19 6 9	29 14 6	33.27	100 : 83.10
Unsanded meadows, pipe drainage	16 16 9	7 18 9	7 18 9	15 17 6	32 14 1	51.47	100 : 212.18
Sanded meadows, pipe drainage	22 7 9	7 18 9	7 18 9	15 17 6	38 5 2	58.52	100 : 282.16
Sanded arable land, ditch drainage. . . .	29 9 1	9 0 4	7 18 9	16 19 1	46 8 2	63.47	100 : 326 64
Sanded arable land, pipe drainage . . .	27 11 1	7 18 9	7 18 9	15 17 6	43 8 6	63.45	100 : 347.25
Unsanded arable land, ditch drainage . . .	10 19 4	8 14 5	7 18 9	16 13 2	27 12 6	39.70	100 : 125.76
Unsanded arable land, pipe drainage . . .	9 1 9	7 18 9	7 18 9	15 17 6	24 19 3	36.42	100 : 114.57

TABLE II. — *Yelds of arable crops* (*lbs. per acre*).

	Sanded land				Unsanded land	
	Actual averages		Figures used in calculations			
	Grain	Straw	Grain	Straw	Grain	Straw
Winter wheat	3 200	6 900	2 850	4 100	1 750	3 750
Rye	3 000	5 200	2 300	5 200	2 600 Spring rye	3 400
Oats	3 350	4 100	2 500	3 750	—	—
Barley	2 600	3 350	1 950	3 000	—	—
Horse beans	3 050	7 500	2 300	3 500	1 875	3 000
Potatoes	28 850	—	17 800	—	16 000	—
Mangolds	60 250	—	53 500	—	53 500	—
Carrots	43 200	—	44 500	—	—	—
Mixed grain and pulse	—	—	—	—	1 875	3 000
Rape and colza	—	—	—	—	1 425	2 700

On account of the high risk in fen farming of damage from frost and pests, deductions are made in the crop accounts, as shown in Table III.

TABLE III. — *Deductions for risk* (*% of gross yield*).

	Sanded crops		Unsanded crops
	Open drains	Pipe drains	Open drains
Winter rye	8	6	20
Spring rye	—	—	15
Oats	10	8	—
Wheat	20	16	—
Barley	24	20	—
Beans	12	10	20
Potatoes	10	10	15
Carrots	12	12	—
Mangolds	12	12	20
Pulse	—	—	22
Rape	—	—	30

On the above mentioned lines the accounts are kept and their chief results are collected in Table IV.

TABLE IV. — *Net returns of crops on fen soil.*

Crop	1 Total cost of farming	2 Value of actual gross returns	3 Returns after deduction of risk	4 Net returns (3—1)	5 Capital in land	6 Interest on capital in land at 4 %	7 Capital in improvements	8 Interest on capital in improvements in £ s d (4—6)	9 Interest on capital in improvements in %	10 Capital value according to net returns capitalized at %	11 Capital value £ s d per acre
	£ s d per acre										
1) Meadows with open ditches	3 16 3	5 11 1	5 11 1	1 14 10	20 2 3	16 1	9 5 1	18 9	10.15	5	34 17 6
2) Meadows without sand	3 0 2	5 19 9	5 19 2	2 19 8	15 17 6	12 9	16 16 9	2 6 11	13.95	6	49 14 3
3) Sanded meadows	2 17 1	6 14 1	6 14 1	3 17 0	15 17 6	12 9	22 7 9	3 4 4	14.36	6	64 3 5
4) Sanded field crops										6	68 11 2
a. Rye. open ditches	5 2 2	10 3 1	9 6 10	4 4 9	16 19 0	13 6	29 9 1	3 11 2	12.08	—	—
a. Rye. pipe drains	5 4 2	10 3 1	9 11 11	4 7 3	15 17 6	12 9	27 11 1	3 17 7	14.10	—	—
b. Oats. open ditches	5 0 6	11 19 11	10 15 11	5 15 4	16 19 0	13 6	29 9 1	5 1 11	17.30	—	—
b. Oats. pipe drains	5 2 6	11 19 11	11 0 9	5 18 3	15 17 6	12 9	27 11 1	5 5 6	19.16	—	—
c. Wheat. open ditches	5 9 6	15 15 9	12 12 7	7 3 1	16 19 0	13 6	29 9 1	6 9 6	21.99	—	—
c. Wheat. pipe drains	5 11 6	15 15 9	13 5 3	7 13 9	15 17 6	12 9	27 11 1	7 1 0	25.60	—	—
d. Barley. open ditches	5 1 3	9 9 6	7 4 0	2 2 9	16 19 0	13 6	29 9 1	1 9 2	4.95	—	—
d. Barley. pipe drains	5 3 3	9 9 6	7 11 5	2 8 3	15 17 6	12 9	27 11 1	1 15 7	6.46	—	—
e. Horse beans. open ditches	5 8 5	9 9 11	8 15 11	3 7 6	16 19 0	13 6	29 9 1	2 13 11	9.16	—	—
e. Horse beans. pipe drains	5 10 5	9 9 11	8 19 11	3 9 6	15 17 6	12 9	27 11 1	2 16 10	10.32	—	—
f. Potatoes (open ditches)	8 1 6	11 18 0	10 14 3	2 12 9	16 19 0	13 6	29 9 1	1 19 3	6 66	—	—
g. Mangolds (open ditches)	6 6 11	14 5 8	10 9 6	4 2 6	16 19 0	13 6	29 9 1	3 9 0	11.71	—	—
h. Carrots (open ditches)	6 19 8	17 17 0	15 14 3	8 14 7	16 19 9	13 6	29 9 1	8 1 0	27.33	—	—
5) Unsanded field crops										5	21 18 7
a. Winter rye	5 5 0	8 0 3	6 8 3	1 3 3	16 13 1	13 3	10 19 4	9 11	4.51	—	—
b. Horse beans	5 8 5	8 2 11	6 10 3	1 1 11	16 13 1	13 3	10 19 4	8 7	3.94	—	—
c. Potatoes	8 1 6	10 14 3	9 2 1	1 0 7	16 13 1	13 3	10 19 4	7 3	3.33	—	—

The results show that a fen farm when suitably drained and managed is profitable from the point of view of both private and public economy.

On the distribution of the area devoted to the different crops the general economic and market conditions have a great influence. Field crops always require a sufficient amount of labour for the suitable tilling of the fen soil.

The cultivation of unsanded fens is to be practised only when the excessive distance from the mineral soil does not allow the dressing to be applied at a reasonable cost.

Underground drainage by means of pipes or fascines is under all circumstances to be preferred to open ditches for permanent pastures and field crops and this all the more the higher the purchase price of the bare soil.

For sanded fen soils, wheat, rye, oats, barley, potatoes, beets, grasses, beans, rape and colza are to be considered as sure crops. Other pulse, as well as serradella and mixtures of pulse and cereals (with the exception of lupins) are not to be quite neglected, but they are less advantageous. Sugar beets are to be grown according to the results of local trial in each individual case. Clover can only be considered in connection with grass leys.

For unsanded fen land the most suitable crops are rye, mixtures of wheat and pulse, beans, potatoes, and Swedes; next come rape and colza; oats and barley must be considered as doubtful. Wheat and beets are in general to be avoided, and they can at most be considered on fens that have been warped.

The injury to fen crops by frost and pests must also be carefully examined with a view to finding the most suitable means of protection. There is, however, a certain compensation between the drawbacks of farming on fens, such as severe winter or spring frosts, various pests and the abundance of weeds, and the fact that fens are better ensured against the consequences of continued drought than the best deep higher soils.

In the droughty year 1911 the valuable loess soils gave miserable yields of hoed crops, clover and spring cereals, while the crops in the fens were not much inferior to the average. At Neu Hammerstein they yielded as follows:

	Lbs. per acre	
Winter rye	3 200 grain	6 000 straw
Horse beans	2 750 »	7 300 »
Oats	3 900 »	5 600 »
Potatoes	40 900	
Mangolds	50 700	
Carrots	83 750	
Meadows	8 000	
Pastures	430 increase of live weight.	

849 – **The Cost of Establishing an Orchard.** — EVANS, L. A. — *The Cultivation of the Apple in Tasmania.* Hobart, 1914.

The following are the data on the cost of establishing two apple orchards, one 25 acres in extent and the other 100.

Twenty-five acre orchard.

	£
Twenty-five acres at £20 per acre (ready for the plough)	500
Fencing, packing-shed and cottage	350
Five thousand trees at 70*s* per 100	175
Planting 25 acres	15
Five years' cultivation, pruning, etc., at £4.10*s* per acre	560
Interest on outlay for five years at 5 per cent. compound interest.	370
Unforeseen expenses	30
Total . . .	£2000

The returns from the fifth to the seventh year may fairly be calculated to pay the orchard expenses. From the tenth year onward the annual return from the orchard should be at least 6 000 bushels. These, at the moderate estimate of 2*s* 6*d* per bushel on the trees, give £750; deduct £225 for working (calculating at £9 per acre), leaving £525, from which the annual interest on £2000 has also to be deducted. Thus there would be a clear income of £425. It must not be forgotten that a *bona fide* settler gives his own work and would thus save £80 a year; in addition if he has £2000 capital he would get the interest on the amount invested, or an average of £74 per year, giving him £154 to live upon until the orchard came into bearing; further that the price of 2*s* 6*d* per bushel on the tree is a moderate price and that by careful attention to packing and good judgment in marketing higher prices can be realized.

The following estimate deals with a 100-acre orchard:

Estimate of cost of 100 acres of land cleared and planted with apples.

	£
First cost of 100 acres of land, at £5 per acre	500
Grubbing, etc., and clearing land to make it fit for ploughing, at £6 per acre	600
Cost of ploughing and subsoiling	100
Two-year-old apple trees at £3 per 100, planting 100 per acre . .	300
Cost of planting	100
Purchase of four farm horses	100
Implements and tools	300
Fencing with wire netting	80
Draining	100
Cost of buildings for manager, workmen, stables, etc.	780
Manuring young trees, artificials	450
Horse feed and cost of keeping horses for one year £100, labour and management £824 per year for five years	4620
Total cost of 100 acres of orchard at the end of five years containing 7-year-old trees	£8000

AGRICULTURAL INDUSTRIES.

INDUSTRIES DEPENDING ON PLANT PRODUCTS

850 – **Refrigeration and Aeration of New Wines as as a Means of Hastening their Maturity.** — KLOSS, J., and SCHNEIDER, F., in *Allgemeine Weinzeitung*, Year 31, No. 28, pp. 313-315. Vienna, July 9, 1914.

The writers carried out at the zymo-chemical laboratory of the College of vine and fruit growing at Klosterneuburg (Austria) several experiments on new white and red wines in order to study the effect of refrigeration followed by intense aeration on the maturing process. The wines, in bottles and in casks, were kept during 24 to 48 hours at temperatures of 28.4 to 26.6° F. (at which temperatures they did not freeze), after which they were aerated (by passing air through them for 24 hours or racking them off and allowing them to fall in a shower through air) and then stored in a cool cellar for a fortnight. They were then filtered and examined. The wine used as control was not refrigerated, but otherwise it was treated in the same way.

The results were as follows : In red wines no effect of refrigeration could be determined. In white wines, on the contrary, the colour was darker than in the control wine and the taste and fragrance had decidedly more of the character of old and ripe wines. Chemical analysis showed a marked decrease in the content of nitrogenous matter; such a decrease is produced only by keeping wine a long time in cellarage and racking it repeatedly. The processes of oxidation, which cause certain constituents of wine (especially those containing nitrogen) to become insoluble and consequently to precipitate, take place much more rapidly in refrigerated wines.

Another benefit derived from refrigeration and aerating was seen in that the wines so treated and then filtered kept perfectly clear, whereas the control wines very soon became turbid, which change is connected with the nitrogenous matter still contained in the wine.

INDUSTRIES DEPENDING ON ANIMAL PRODUCTS

851 – **Development and Present Situation of Milk Recording and Book-keeping Associations in Denmark.** — *Prepared from a communication from* A. C. DUBORG, *Adviser, Rudköbing, Denmark.*

According to a communication from the Danish Statistical Bureau, there were in 1909, 519 Record Associations in receipt of subventions from the State. Of this number 128 had been founded between 1895 and 1899, 207 between 1900 and 1904 and 184 between 1905 and 1909.

In 1909, 12 572 farmers possessing 224 837 cows were members of record associations, while 167 235 farmers with 1 047 316 did not belong to any association, and 2 566 farmers with 9 821 cows had not sent in any answer to the enquiry.

The following figures for the year 1909 show the connection between the size of the farms, the number of animals and milk recording :

Size of farm	Percentage of farms in which milk records are carried out	Percentage of cows under record out of total of country
up to 1.36 acres	0.3	0.5
from 1.36 to 12.26 »	1.1	1.4
» 12.26 » 36.80 »	3.3	4.7
» 38 80 » 73.60 »	11.2	14.8
» 73.60 » 147.20 »	18.9	24.5
» 147.20 » 588.82 »	21.1	34.4
Above 588.82 »	38.8	46.3
On the whole . .	7.2	18.0

It is thus evident that it is mostly the larger farms that submit their cattle to milk recording.

Many of the larger farms carry out milk recording by themselves and these are not included in the above figures.

The number of milk recording associations has been almost stationary since 1909; this is due to the fact that the greater part of farmers interested in cattle breeding, in so far as conditions allow, belong already to these associations.

In northern and western Jutland there are only a few record associations, as there fattening is prevalent. On the islands and in south-eastern Jutland about a quarter of the number of cows are under record, in Fünen a third.

By the union of the associations into federations a certain uniformity of method is attained. Milk recording has already exerted some influence on breeding. At cattle shows only bulls which can show controlled performance records of their dams, grandams, etc., are exhibited. In Fünen fairly high performances of the dams have been required as the lowest limits for admission to the shows.

The law of June 8, 1912, provides a yearly state subvention of £5 600 for these associations, each of which gets £11 on condition of conforming to certain regulations.

A record association has usually from 15 to 25 members with about 400 cows. The control work is carried out about every 20 days. The yearly cost per cow amounts to from 1*s* $5\,^3/_4 d$ to 1*s* $10\,^1/_2 d$ per cow and without the State grant to 2*s* 2*d*; in these sums the board and lodging given by the members to the control assistant are not reckoned.

Of late years the tendency is towards entrusting the control assistants not only with the accounts immediately connected with the milk records but also with the whole book-keeping of the farm. Thus the record associations gradually become book-keeping associations. The beginnings of these associations were fairly simple but not uniform. In the year 1908 such a book-keeping association was founded at Langeland and it has been followed by others. The work of milk recording goes on in them as usual, only as the book-keeping associations are smaller, the records

can be made oftener, which is all to the advantage of the greater trustworthiness of the results. Tha farm accounts at the same time supply a certain check on the performance records. The number of members is, as a rule, from 15 to 18; they farm from 1 200 to 2 000 acres and own 200 to 300 head of cattle.

The cost of the book-keeping is reckoned on the basis of the acreage of the farm, while the cost of milk-recording is based on the number of head of cattle, as in the other record associations. A farm of 61 acres pays for its book-keeping from 22 to 33*s* a year. The farmers enter in specially prepared books and a cash book the several transactions according to the system of simple entry. When the record association assistant visits the farm, for the first time in every month, he posts the farmer's entries in the regular account books kept on the double entry system. This has the advantage that any error can be rectified at once *viva voce* and on the spot. According to the wish of each member the books are kept with a greater or lesser number of accounts. In general the farmers desire to know the returns of the various crops and the profitableness of the different branches of their farms.

852 – **Preserving Milk Samples for Examination.** — TILLMANNS, F., SPITTGERBER, A., and RIFFART, H., in *Zeitschrift für Untersuchung der Nahrungs- und Genussmittel sowie der Gebrauchs-Gegenstände*, Vol. 27, Part 12, pp. 893-901. Münster i. W., June 15, 1914.

According to the writer's experiments the requirements of an ideal means of preservation are: 1) It must preserve the degree of acidity of the milk for at least 72 hours. 2) It must not bring about any change in the behaviour of the milk to alcohol. 3) It must cause no change in the physical and chemical composition of the milk. 4) It must not have any action on the nitrates which may be contained in the milk and especially *a*) it must preserve the nitric acid from decomposition, *b*) it must have no action on diphenylamine, neither weakening nor reinforcing its effect.

In view of these requirements the experiments made by the writers in their research for the most suitable substance, led to the discarding of a number of substances commonly used. They tried chloroform, thymol, oil of mustard, phenol, creosote, sodium fluoride, mercuric chloride, and potassium bichromate. The latter substance reacts strongly on diphenylamine and should have been discarded, but it was tested owing to its current use.

The examination of the above-named substances led to the following results:

Thymol, phenol, creosote and sodium fluoride cause the milk to coagulate after 24 to 48 hours. Bichromate of potash, owing to the intense yellow colour it gives to milk, does not allow an accurate determination of the degree of acidity to be carried out. Chloroform causes an increase of refraction and of fat content. Creosote causes a decrease of specific gravity. Thymol and creosote enfeeble the diphenylamine reaction to a considerable extent. This is also the case in a small degree with oil of mustard and phenol. Bichromate of potash causes milk to give a strong

positive reaction with diphenylamine, even without the addition of a nitrate. Of all the means of preserving milk only chloride of mercury answers to the above-mentioned requirements. When used in a 0.04 to 0.03 per cent soution it preserves milk quite fresh for 120 hours without any noticeable increase of acidity.

Further it has no action whatever upon the milk constants and allows the quantitative determination of nitrates to be carried out even after 120 hours. The use of chloride of mercury for official milk control is, however, owing to its poisonous nature, only admissible with certain precautions. Thus to allow it to be easily recognized the writers add Congo red to the sublimate. This colouring matter, used at the rate of 0.2 cc. of a 2 per cent. solution in water in 250 cc. of milk, has no effect at all upon the results of the analysis of the latter.

PLANT DISEASES

GENERAL INFORMATION.

LEGISLATIVE AND ADMINISTRATIVE MEASURES.

853 – **Decree of the President of the French Republic, June 9, 1914, Authorizing the Introduction into France of Plants other than Vines through the Dijon Customs House.** — *Journal officiel de la République française*, Year 44, No. 166, p. 5389. Paris, June 20, 1914.

Art. 1. — Trees, shrubs and all plants other than vines coming from foreign nurseries, gardens, hot-houses and orangeries may be introduced into France through the Dijon Customs House under the conditions set forth in articles 2 and 3 of the decree of August 28, 1882.

Nevertheless, the certificate of the competent authorities of the country of origin will not be required when the plants come from an establishment entered in the lists published according to article 9, paragraph 6, of the International Phylloxera Convention.

Art. 2. — The Ministers of Agriculture and of Finance are charged, in their respective spheres, with the carrying out of the present decree.

854 – **Order of the French Minister for the Colonies, June 19, 1914, forbidding the Importation of Hevea Plants into Indo-China.** — *Journal officiel de la République française*, Year 46, No. 170, p. 5488. Paris, June 24, 1914.

Art. 1. — The importation into Indo-China of hevea plants is forbidden ; the introduction into the Colony of hevea seeds is allowed and is not subject to any disinfection.

Art. 2. — The Governor-general of Indo-China is charged with the execution of the present order.

855 – **Order of the French Minister for the Colonies, June 19, 1914, Establishing Regulations Concerning Disease in Coconut Plantations in Cochin-China and in the Annam and Cambodia Protectorates.** — *Journal officiel de la République française*, Year 46, No. 171, pp. 5534-5535. Paris, June 25, 1914.

Art. 1. — A regulation concerning disease in coconut plantations has been established on the following bases in the Colony of Cochin-China and in the Annam and Cambodia Protectorates.

Art. 2. — Any person, owner, manager, farmer or holder in any way of coconut plantations which have been attacked by the Coleoptera known as elephant beetle or black beetle (*Oryctes rhinoceros* L. ; in Annamese the perfect insect is called " con kien vuong " and its larva " con sung ") or those known as coconut weevil (*Rhynchophorus ferrugineus* Oliv. ; in Annamese the perfect insect is called " con bu xe ", its larva " con duong ") or by any other insect or in general by any disease of whatever nature, must immediately declare it to the nearest native or French authorities, who will without delay forward such declaration to the Chief Administrator of the Province, who, after having ordered a technical examination of the plantation, will order one of the following measures.

Art. 3. — If the trees are only slightly attacked by the elephant beetle, that is to say if only 5 or 6 holes bored by the insect have been found, the owner or other person in charge must have the holes stopped with a composition containing pitch, coal-tar or similar compounds, and must destroy throughout the property all the sources of infection as defined in art. 5 ; he must also carry out such other measures as may be ordered by the authorities, in particular those which will be set forth in the special instructions published by the Administration.

Art. 4. — If the trees are either dead, badly attacked by the elephant beetle, or simply attacked by the weevil, they must be uprooted and either entirely destroyed by fire or completely immersed in water so that the eggs, larvae, pupae or perfect insects be destroyed and that the débris may not became a breeding place or a refuge for new parasites.

Art. 5. — Any person possessing lands at a distance of less than 2 km. (1 ¼ mile) from a coconut plantation (that is an area planted with about 40 coconut palms per acre) is bound to destroy on the land belonging to him, the palms or other plants attacked by the elephant beetle or the weevil, to remove or destroy the dead plants, trunks or debris of coconut trees, and the heaps of manure or any other decomposing organic matter in which the presence of larvae of beetles has been detected or which may become sources of infection.

Art. 6. — The Chief Administrators of the provinces and their assistants, the Agents of the Agricultural and Commercial and Forest Services, or any officials appointed by the Government, are to have free access to the coconut plantations, whatever their extent, in order to ensure the observance of the present Order. They can draw up reports which will be conclusive in default of proof to the contrary.

Art. 7. — Any person refusing or neglecting to comply with the instructions contained in the above articles 1, 2 and 3 is subject to the penalties set forth in articles 479 and 482 of the Penal Code.

Art. 8. — The same judgment inflicting the above penalties may, in the cases contemplated by articles 4 and 6, order the destruction of the trees or sources of infection by the village and at the expense of the offender. If it is an European or a person considered as such, this destruction will be carried out in the same way but under the supervision of a police officer.

Art. 9. — The Governor-general of Indo-China is charged with the execution of the present Order.

856 – Italian Royal Decree of May 3, 1914 (No. 425), Instituting an Independent Phytopathological Observatory at Turin. — *Gazzetta Ufficiale del Regno d'Italia*, Year 1914, No. 136, pp. 3056-3057 Rome, June 10, 1914.

Art. 1. — An independent Phytopathological Observatory is founded at Turin on the initiative of the Agricultural Association (Comizio Agrario) of Turin ; the expenses are defrayed by the Commune, the Savings Bank, the Chamber of Commerce, the Charitable Foundation of St. Paul, the Grand Masters of the Orders of Saints Maurice and Lazarus and of the Crown of Italy, and the Agricultural Association, with assistance from the State.

Art. 2. — The objects of the observatory are : *a*) to follow carefully any condition of disease in cultivated plants and to study its causes and remedies ; *b*) to spread among farmers, by means of meetings, talks and practical lessons to be given in various localities, a precise knowledge of the diseases of plants and of the best means of controlling them ; *c*) to start, with the cooperation of farmers, experiment fields for the protection of plants against the most widely spread diseases ; *d*) to watch over the public gardens and avenues of the city of Turin from the point of view of plant diseases and at the request of the Municipality, and if necessary to assist in the application of suitable means of control ; *e*) to examine doubtful mushrooms and other fungi at the request of the Bureau of Hygiene ; *f*) to give verbal or written consultations to the farmers of the district ; *g*) to attend to the institution of a special Museum of Plant Pathology ; *h*) to examine the seeds of cultivated plants as to purity and germination ; *i*) to undertake the services of vigilance, warning, prevention and cure of the diseases of plants in Piedmont.

Art. 3. — The observatory is managed by a Board of Administration composed of representatives nominated one each by the Ministry of Agriculture, the Turin Savings Bank, the Turin Agricultural Association, the Municipality of Turin, the Chamber of Commerce and Industry of Turin, the Charitable Foundation of St. Paul, the Grand Master of the Order of St. Maurice, and those bodies or private persons who contribute annual subscriptions of not less than £ 20. The members of the Board hold their seats for three years and may be re-elected. The Board elects from among its members a president, also for three years and eligible for re-election. The director of the observatory is a member of the Board and acts as secretary.

Art. 4. — The Director is at the head of the scientific activity of the Institute ; he must present every year to the Board of Administration a report upon the work done in the course of the year, the programme of the experiments to be carried out in the following year, the estimate of the expenses and the balance sheet of the preceding year, audited by an accountant who is elected every three years by the Board and who may assist at the Board meetings as advisory member. Every year a copy of

each of these documents will be sent to the Ministry of Agriculture, Industry and Commerce.

Art. 5. — Besides the Director, the staff of the Observatory includes an Assistant Director and a Curator-Secretary. The Assistant Director has the supervision of the Laboratory and, when necessary, replaces the Director. The Curator-Secretary is entrusted with the books, correspondence, library and collections, and if he has a degree he may substitute the Assistant-Director. If the budget allows, a second Assistant may be engaged according to the decision of the Board of Administration. The President, after consulting the Director, may nominate one or two special volunteer or honorary unpaid Assistants, who will have the right to frequent the Observatory and to make use of the scientific material according to rules laid down by the Director.

Art. 6. — The Director is nominated according to the results of a competition organized by the Board of Administration and his nomination must be approved by the Ministry of Agriculture. The rest of the staff is nominated by the Board of Administration on the proposal of the Director.

Art. 7. — The funds of the Observatory are provided as follows: the State contributes £80 under chap. 66 of the Budget of the Ministry of Agriculture, Industry and Commerce for the year 1913-14, and in the corresponding chapters for the succeeding years; the Municipality of Turin £ 20; the Turin Savings Bank £ 80; the Chamber of Commerce of Turin £ 20; the Grand Master of the Order of Saint Maurice £ 20; the Charitable Foundation of St. Paul £20; the Agricultural Association of Turin £ 10. The Commune, besides its pecuniary assistance, provides housing, water, gas, stationery and plant other than scientific (furniture, etc.). The Ministry of Agriculture will also, in virtue of the Law of June 26, 1913 (No. 888), which deals with measures for the prevention and cure of the diseases of plants (1), furnish special funds for the services of vigilance, reporting, prevention and treatment of diseases of plants in Piedmont.

Art. 8. — The advice given to farmers is free of charge. The Board of Administration may however establish a tariff for the reports and other work demanded by the public.

Art. 9. — Other local institutions may give their adhesion to the present Statute, lending their aid to the Observatory and securing representation on the Board by agreement with the founders and with the approval of the Ministry of Agriculture, Industry and Commerce.

Art. 10. — Special regulations proposed by the Board and approved by the Ministry of Agriculture will regulate the working of the Observatory.

Temporary provision.

Art. 11. — The present staff (Director and Assistant Director) of the District Observatory (2) will continue its work in the Independent Phytopathological Observatory.

(1) See No. 995, *B.* Aug. 1913.
(2) See No. 278, *B.* Jan. 1911 and pp. 1000-1005, *B.* July 1913. (*Ed.*)

BACTERIAL AND FUNGOID DISEASES.

GENERALITIES

857 – **The Conditions determining the Outbreak of Vine Mildew in Hungary** (1). — *Communicated by Dr.* Gy. Von Istvanffi, *Professor at the University and Director of the Royal Hungarian Central Ampelological Institute, Budapest.*

The Royal Hungarian Central Ampelological Institute of Budapest has now published (in Magyar) the fifth volume of its works ; this contains the studies made by Dr. F. Sávoly under the direction of Dr. Gy. von Istvanffi. An abstract has also been published in French, as Vol. V of the *Annals* of the Institute ; this was prepared on the occasion of the International Congress of Viticulture held at Lyons from July 20 to 22, 1914.

The most important results of Dr. Sávoly's work may be summarized as follows :

I. — The climatic conditions required by mildew cannot be determined except by carrying on researches for several years on an extensive and varied territory and by methodically working up the data thus obtained.

II. — Only study of the weather before the first appearance of mildew can lead to satisfactory results. It is sufficient to consider the temperature and the quantity and frequence of the rain. As unit of territory, the district (" járás") has been taken. The dates of the first appearance of the disease were noted on a map and the parts in which it appeared simultaneously were joined up by lines. The curves so obtained are called " isophanes " and the areas enclosed between them " isophanic belts ". Starting from the first appearance of mildew and proceeding to the relatively late appearances, we distinguish a series of isophanic belts, each member of which corresponds to a period 1.55 times as long as the preceding one.

III. — Comparing the data obtained from 1910 to 1912 the following observations can be made : 1) The earliest appearance of mildew in Hungary was on May 21. 2) In general most of the dates of appearance were between June 5 and 15, that is to say during the flowering -period of the vines. 3) The date of the infection which causes this general outbreak of the disease must be sought in the last ten days of May.

IV. — The comparison of the mildew maps of the last four years gives the following results : 1) The first appearance of mildew occurs in the same locality every year, and its spread almost always follows the same main routes. 2) This characteristic constancy does not depend so much upon the weather as upon orographic causes and those connected with the nature of the soil. 3) In its spread mildew does not make jumps, but proceeds gradually from one locality to another ; starting from the point at which it first appeared, numerous transition points are found towards the spots in which it appeared later. 4) The speed at which mildew spreads is not the

(1) See also No. 68, *B.* Jan. 1913; No. 1208, *B.* Oct. 1913 ; and No. 529, *B.* June 1914. (*Ed.*)

same in all directions, but the speed in the several directions seems to be constant every year.

V. — The features more or less common to these four years are very visible on the map representing the appearance of mildew in its general outlines. It is seen also: 1) That in general mildew starts from a triangular area the vertices of which lie near Kaposvár, Villany and Kecskemét. 2) That the disease advances for a certain time approximately in the directions marked by the angles of this triangle. 3) Independently of this first area, and one or two isophanes later, secondary centres of infection are observed, especially in the Kis-Alföld (Small Hungarnia Plain), then near Versec and on the sands of Hajdu and Szabolcs counties. The last-named is the most important, as it is the point of departure of an independent invasion.

VI. — Mildew generally makes its appearance in the following order: first in the country to the north of the Mecsek mountain, between Kecskemét and Lake Balaton, and in the valley of the Danube towards Mohács; a little later on the plain in the angle between the Danube and the Drava and the northern part of the sandy land in Pest county; next follow the country about Versec and Fehértemplom and the sandy region of Hajdu and Szabolcs counties, which are separated from the central part of the Great Plain by a belt in which the disease appears late. After these two sandy regions comes the Kis-Alföld.

VII. — Mildew appears relatively late on the alluvial soils of the left bank of the Tisza, and along the Bodrog and the Maros and especially in the parts watered by the three branches of the Körös and the Berettyó, as well as on both banks of the Tisza (in Szolnok and Heves counties) from Szolnok as far as Tokaj; the same is the case in Torontál and Temes counties, in the valleys of the Temes and of the Bega, and in the southern parts of Bács county; the orographic and climatic conditions of these localities differ very little from those of the districts in which mildew appears early. This delay is rather due to the lack of great extents of sandy soil and the presence of large areas on which water stands.

VIII. — The disease appears latest, about 60 or 80 days after the first appearance in Hungary, in the western, southern, north-eastern and south-eastern parts of vine-growing Hungary situated at heights above 200 m. (660 ft.) and lastly in the eastern parts (Transylvania).

IX. — It appears from the study of the climatic data that the temperature of the month of April has a determining influence on the appearance of mildew. Provided there is enough moisture in winter and spring, which is almost always the case, mildew appears the earlier the more regular the rise of temperature in April. If in the month of April or at least in its second half night frosts have ceased (even though the warmth during the day may not be considerable), the appearance of mildew may be expected about the middle of May. But if there are repeated relapses in the rise of temperature in April the appearance of mildew will be retarded. This retardation will be all the greater the more frequent the relapses have been

and the longer they have lasted. In this case the appearance of mildew may be retarded to the end of May.

X. — The account of the weather before the first appearance of mildew has been kept as follows. A determination was made for each locality and then for the whole of the country situated within the same isophanes of the amount and frequency of the rainfall and the mean daily temperatures from April 1. By multiplying these three data by the number of days after April 1, a figure has been obtained in which the climatic factors appear in proportion to their biological value.

These biological values of the weather seem to show that in general mildew makes its appearance in a district when the biological value of the weather reaches the figure that it had in the first isophane of the year. The great deviations that the biological values of the different years present may be eliminated by introducing into the calculations a factor connected with the value of the position of the rain. (1) The biological value thus obtained for 1910 to 1913 is 281 $\pm$ 14.

The writers call this figure " Bios ". It expresses the value given by the weather calculated according to the above formula, when the meteorological conditions for the first appearance of mildew have been realized. Expressed in a mathematical formula: $-B = c.\,g\,h.\,k.\,T$, in which B = Bios, c = the mean rainfall from the first of April to the day of the first appearance of mildew, g = the average of its frequency, h = the mean daily temperatures, k = the influence of the date at which the rain fell, T = the number of days of the period.

The regular decrease noticed in the table of the " Bios " values may serve as a kind of forecast. It is assumed that after the first isophane there will be no greater irregularities in the weather than in the period between the 1st of April and the first isophane. The deductions are made according to the rule of three, using the " Bios " of the first isophane and the " Bios " of the isophane in question. A series of numbers in inverse ratio to the series of decreasing " Bios " values is thus obtained.

Carrying out this calculation for the years 1910 to 1913 the following numbers of days are obtained:

Isophane		II	III	IV	V	VI	VII
1910		**51**	**55**	**63**	**69**	**83**	**90**
		51	56	63	74	91	117
1911		**47**	**57**	**65**	**73**	**80**	**97**
		47	52	59	70	87	113
1912		**56**	**60**	**63**	**65**	**71**	**86**
		61	66	73	84	101	127
1913		**55**	**66**	**65**	**79**	**80**	**81**
		53	58	65	76	93	119

The figures in heavy type show the date on which mildew was calculated to appear, those in ordinary type the actual date of appearance.

(1) This refers to the fact that rains of equal amount are more effective when they fall nearer to the date of appearance.

It will be seen that the two sets of figures show very considerable agreement.

The prognostic value of these series is undoubted, but their application is limited by the delay of three days necessary in calculating from the first isophane.

But the formula $B = c.g.h.k.T.$ renders one independent of the first isophane; it has only to be borne in mind, according to the process described in the original work and for a great number of localities situated as regularly as possible, when the "Bios" attain towards the middle of May the value of 281 $\pm$ 14. It is in such localities that the appearance of mildew may be expected shortly; in this forecast use may advantageously be made of the temperature curve of the month of April and of the knowledge of ecological factors. One of the chief conditions of success of this method is a network of meteorological stations in perfect working order and with telegraphic connection.

XI. — According to these researches the districts in which mildew makes its first appearance in Hungary are determined by orographic and climatic conditions and especially by the nature of the soil and the conditions of superficial hydrography. The weather only influences the date of appearance. The disease does not appear first in the warmest districts and where most rain falls, but in the southern part of the Great Hungarian Plain where there are extensive sandy areas and a number of tracts liable to flooding. On the other hand the disease appears late, even in the southern districts, on cold soils, notwithstanding the abundance of superficial water and favourable weather. After an April with regular temperature and without white frosts the first appearance of mildew may be expected about the middle of May, and in general when the value of the "Bios" calculated from the 1st of April reaches the figure of 281.

858 – **Results of Investigations made in Austria in 1913 into the Leaf-curl of Potatoes** (1). — KÖCK, G., KORNAUTH, K., and BROZ, O., in *Zeitschrift für das landwirtschaftliche Versuchswesen in Oesterreich*, Year XVII, Part 5, pp. 270-300. Vienna, 1914.

During 1913 the writers continued in several parts of Austria the research work which had been commenced on a large scale several years ago. Among other investigations they carried out a whole series of infection experiments with different species of *Fusarium* on several varieties of potatoes by simply surrounding the root crown of the plants with infected soil.

The most important conclusions that have been drawn from these and from the preceding investigations are the following:

1). Leaf-curl is a fungoid disease caused by forms of *Fusarium* or *Verticillium*; the former are predominant towards the south (for instance in Austria-Hungary), the others towards the north (northern Germany).

2). The primary infection (that is that of a plant that till then had

(1) See also No. 580, *B.* June 1914; No. 683, *B.* July 1914. (*Ed.*).

been heatlthy and had sprung from a healthy plant) is caused by soil containing the above disease-producing agents.

3). The tubers obtained from a plant attacked by leaf-curl are not all necessarily diseased ; some shoots may be quite immune and will naturally produce sound tubers ; tubers formed on the shoots infected by the fungus are in some cases more or less infected by the mycelium of the parasite, or when the mycelium remains restricted to the vascular bundles of the haulm and the stolon, such tubers appear singularly weakened by the injurious action of the mycelium on the movements of the sap.

4). When tubers infected by the mycelium are planted, one of the two following circumstances is observed : either the mycelium grows (and this is rather rare) in the young shoots in course of formation — and the result is what the writers call " secondary infection ", with a new appear ance of curled leaves, — or (as is the case with tubers not containing mycelium but weakened) sickly and weak plants are produced but without leaf-curl ; the writers give this the name of " Folgekrankheit " (after-effect of the disease).

5). Leaf-curl and its after-effects may be spread by tubers produced by shoots which had suffered from primary infection (deriving from the soil).

6). Different varieties of potatoes possess a very different resistance to the disease ; it seems as if none were completely immune.

7). For the control of the disease the following measures are recommended : *a*) to abstain from growing potatoes for at least five years in those fields in which leaf-curl has appeared ; *b*) to select seed potatoes with the greatest care, to grow only varieties which have proved suitable to the locality and to choose a favourable soil ; *c*) to strengthen the plants by appropriate manuring ; *d*) to pick out carefully and remove from the growing crop any infected plants.

BACTERIAL AND FUNGOID DISEASES OF VARIOUS CROPS

859 – **A Disease Affecting the Sisal Hemp Plant : *Colletotrichum Agaves* Cav.** (1). — BANCROFT, C. K., in *The Journal of the Board of Agriculture of British Guiana*, Vol. VII, No. 4, pp. 181-182. Demerara, April 1914.

The leaves of sisal hemp (*Agave rigida* var. *Sisalana*) grown in British Guiana have during the past five years been affected by a disease which renders them useless for the preparation of the fibre, and which is due, according to laboratory observations, to *Colletotrichum Agaves* Cav.

As far as is at present known the parasite has appeared only on plants grown away from the coast, but the plant has not been cultivated near the coast to any great extent.

The fungus has been grown on artificial media. Inoculations on the cut surfaces of leaves (incisions, wounds, etc.) have confirmed the observations of Shaw on the reproduction of the disease and on the pathogenic agent. Attempts to reproduce the disease by placing the fungus on uninjured surfaces of the leaves have failed, thus again confirming the con-

(1) See No. 883, *B.* July 1913. (*Ed.*).

clusion that the organism is a wound parasite, *i.e.* can only affect the leaf originally at a broken surface.

860 – **The "New Disease" or "Dry Disease" of the Sugarcane: *Marasmius Sacchari*.** — BANCROFT, C. K., in *The Journal of the Board of Agriculture of British Guiana*, Vol. VII, No. 4, pp. 183-187. Demerara, April 1914.

The writer describes under the name of "new disease" or "dry disease" the disease caused on the sugarcane by the fungus already known under the name of *Marasmius Sacchari*. The disease was first observed in British Guiana at Berbice in 1907; it has subsequently been reported to occur on many estates in different parts of the Colony. On some of these it has extended greatly, while on others it does not appear to have progressed rapidly and in some few cases it has disappeared after a short time.

The writer reports upon the methods employed in combating the disease. The varieties which are generally badly affected in this Colony are Bourbon, D 625, B 208 and Green Transparent. The two former suffer more than any other varieties. D 109 is also frequently affected; D145 and D 118 are more resistant, while D 216 and D 159 are not reported to be affected.

The planting of the more resistant varieties in badly affected fields for a period of several years for the purpose of checking the spread of the disease is a matter which should receive careful consideration, as well as replacing infected stools with plants of more resistant varieties. The object of these methods would be to reduce the fungus in the soil to a minimum before replanting with the more susceptible varieties.

861 – **Two New Species of Fungi in Tobacco Seeds Beds: *Gloeopeziza turricula* and *Hyalopus geophilus*.** — SACCARDO, P. A., and PEYRONEL, B., in *Bollettino tecnico della coltivazione dei tabacchi, pubblicato per cura del R. Istituto sperimentale in Scafati (Salerno)*, Year XIII, No. 1, pp. 3-6, 1 plate. Scafati, 1911.

The writers received from the Royal Experiment Institute for the Cultivation of Tobacco at Scafati two samples of mould from tobacco seedbeds, attacked by two species of fungi which they consider new to science and which they describe under the names of *Gloeopeziza turricula* and *Hyalopus geophilus*.

The former is a discomycete characterized chiefly by its ascophores, which are cylindrical or shaped like elongated truncated cones resembling little towers (whence the specific name); it is visible as brick-red dots on the mould, and, according to the information collected by the writers, it appears generally in January and February on the seedbeds formed of mould, which have previously been warmed and are protected by coverings. It develops in patches, frequently large, and forms a kind of red crust that hinders the development of the germinating tobacco seeds and often kills them. The species is allied to *G. Rehmii* Zuk. and *G. Zukalii* Rehm, from which it is easily distinguished by certain morphological characters. In another sample of mould received later the writers recognized *G. turricula* in a very young stage of development; this material allowed of preliminary observations on the sexual organs (carpogonia

and antheridia) contained in the young ascophores, which are then completely red.

Hyalopus geophilus (Mucedineae) is very minute and completely hyaline, so that it is difficult to distinguish it without the help of the microscope; this fungus develops on the same places as *G. turricula*, over which it spreads.

These two species do not live on moulds that have been carefully heated to about 100° C. (212° F.) for a couple of hours. Such partial sterilization is therefore recommended for the prevention of these fungi, as well as of parasitic diseases, weeds, etc.

862 – ***Cladochytrium Mauryi* and *C. Ollivieri*, New Phycomycetes on the Leaves of *Colchicum autumnale* and of *Orchis incarnata* and *O. laxiflora* in France.** — HARIOT, P., in *Comptes rendus hebdomadaires des séances de l'Académie des Sciences*, 1914, 1st Half-year, Vol. 158, No. 23, pp. 1705-1707. Paris, 1914.

The writer describes (with Latin diagnosis) two new species of *Cladochytrium*. One, *C. Mauryi*, was found in May 1914 on leaves of *Colchicum autumnale* at Châlons-sur-Marne; it seems to differ from all the other species that have been described as parasites of Liliaceae and Irideae. The other, *C. Ollivieri*, was found in May and June of the same year on leaves of *Orchis incarnata* and *O. laxiflora* at Esbly (Seine-et-Marne).

C. Ollivieri is very near *C. Mauryi*, but can be distinguished by the spots it forms being darker, longer and smoother; its spores also seem larger.

Orchis laxiflora appears to be only exceptionally attacked, and the spots upon it seem smaller and more scattered and never run together to occupy the whole area of the leaf. At Esbly plants of *Colchicum* growing in abundance among the orchises are never attacked; at Châlons-sur-Marne on the contrary the orchises are never attacked.

The leaves of *Orchis* on which *C. Ollivieri* is growing are frequently infected by the aecidium stage of *Puccinia Orchidearum-Phalaridis* Klebahn.

Perhaps the two species of *Cladochytrium* are only biological species and resemble in this the rusts of the group of *Puccinia graminis* and *P. Rubigo-vera*, and the species of *Peridermium*.

INSECT PESTS.

GENERALITIES

863 – **Occurrence of the Colorado Beetle (*Leptinotarsa decemlineata*) in Germany** (1). — *Illustrierte landwirtschaftliche Zeitung*, Year 34, No. 57, pp. 538-539, 1 fig. Berlin, 1914.

The presence of the Colorado potato beetle (*Leptinotarsa decemlineata*), which had not been seen in Germany since 1887, has been reported from Hohenwedel near Stade (Hanover); the Government immediately ordered the most drastic measures against this dangerous beetle.

(1) See also Nos. 2295 and 2360, *B.* July 1911. (*Ed.*).

864 – ***Micrococcus nigrofaciens*** **as Cause of an Infectious Disease of the Larvae of *Lachnosterna* spp. in the United States and in Portorico.** — NORTHRUP ZAE. in *Centralblatt für Bakteriologie, Parasitenkunde u. Infektionskrankheiten*, Part II, Vol. 41, No. 11-17, pp. 321-339, figs. 1-5, plates I-IV. Jena, 1914.

During the summer of 1912 specially severe injury to various crops due to the white grubs of May or June beetles (*Lachnosterna* spp., *Scarabaeidae*) were reported from Michigan.

The appearance of these beetle larvae was accompanied by the manifestation of a bacterial disease characterized by the blackening of the parts of their bodies affected. The cause of the infection is a species of *Micrococcus*, for the above reason named *M. nigrofaciens*. It was found under the microscope in almost pure culture on agar plates inoculated from the diseased part of a live larva. It is frequently associated with a gas-producing bacillus (*Bacillus septicus insectorum* of Krassilstschik ?), from which it is separated with difficulty.

The *Micrococcus* lives in the soil and is present in many soils of Michigan, Illinois, Maryland, Northern Carolina, Portorico and very probably in other countries also. It grows well on the usual nutritive media, but much better on the special media prepared with the larvae (gelatine, agar, broth) and on the larvae themselves. It colours well with the usual water and alcohol colours, and shows clearly the process of division ; it is Gram-positive but not acid-fast.

The disease has been successfully reproduced in a healthy larva of *Lachnosterna* by placing it on artificially infected soil and incising its integument.

The characteristic alteration was also caused in some healthy larvae of another beetle, *Allorhina nitida*, by placing them on soil soaked with water and sterilized, to which some broth containing the *Micrococcus* in suspension was added. It seems as if in the individual larvae of the same genus the power of resistance to the *Micrococ us* varies greatly. The youngest seem to be the most susceptible ; the larvae of *Lachnosterna* seem less resistant than those of *Allorhina*.

The micro-organism in question proved pathogenic to adults of *Periplaneta americana* ; the disease followed its course as in the larvae of *Lachnosterna* ; nevertheless the infection was apparently limited to the legs.

It has not been possible to determine whether the *Micrococcus* is pathogenic for earthworms, nor have repeated attempts to isolate it from the naturally infected soil succeeded.

Excessively moist soil favours the progress of the disease and this may be considered one of the chief factors in rendering the infection mortal.

In the soil there exist other organisms which may produce an infection in the larvae. The above-mentioned gas-producing bacillus found in the culture plates appears in determined conditions to contribute to render the disease mortal and it may be the first micro-organism to invade the insect.

The *Micrococcus* does not lose its virulence after having been cultivated artificially for upwards of a year.

It has not yet been possible to try this micro-organism as a remedy in the control of the larvae of *Lachnosterna* ; this will, however, be done as soon as possible. The larvae of some *Lachnosterna*, commonly called " caculo " or " gusano blanco " at Portorico, are there very injurious to sugarcane : in order to experiment the *Micrococcus* against them, cultures have been sent to Rio Piedras and Mayaguez ; no definite results have been obtained.

From the conclusive results obtained by inoculating and saturating the soil, the inference may be drawn that the *Micrococcus* may in the future be usefully employed in the control of the larvae of *Lachnosterna*, especially in conjunction with other parasitic diseases to which the larvae are subject. Since this micro-organism has also the power of infecting the larvae of another genus (*Allorhina nitida*) and also adult insects (*Periplaneta americana*), it seems to suggest the possibility of extending its use, applying it especially in the control of other injurious larvae in the soil.

INSECTS INJURIOUS TO VARIOUS CROPS

865 – **The Grass Moth *(Remigia repanda)*, a Pest of Sugarcane, Rice and Paragrass in British Guiana** (1). — BODKIN, G. E., in *The Journal of the Board of Agriculture of British Guiana*, Vol. VII, No. 4, pp. 171-177. Demerara. April 1914.

Remigia repanda is a member of the family *Noctuidae;* owing to its habit of living on numerous grasses, and particularly paragrass (*Panicum muticum*) it has been given the popular name of Grass Moth. In British Guiana it has been a well-known pest for many years, though this is the first account of its life-history published in the Colony.

On sugarcane, rice — with the rice caterpillar (*Laphygma frugiperda*) — paragrass and other grasses throughout the coastlands this moth may be found all the year round, and at certain periods, particularly on the occurrence of rain after prolonged drought, the larvae appear in vast hordes completely destroying whole areas of the above crops. It also occurs in several of the interior districts.

In Trinidad it has recently occurred as a serious pest and it is also known as a pest in Jamaica. The following are the localities whence *R. repanda* has been recorded : Canada, Labrador, United States (Texas, Florida), Mexico, Honduras, Costa Rica, Panama, Colombia, Venezuela, Guiana, Brazil, Argentina, Antilles (Cuba, where it has beea recorded on *Hypericum*, San Domingo, Jamaica and Martinique).

Under normal conditions this insect is not responsible for any serious damage and may easily be controlled.

The various instars of the life-history of this insect in the Colony coincide with those which have been described by Dr. Dyar of the United States ; his description is appended by the writer. The ova have never been observed on the food-plants in this colony. The complete life-cycle occupies under normal circumstances from 26 to 31 days.

No actual parasites have so far been secured from this insect in Bri-

(1) See also No. 803, *B.* Aug. 1914. (*Ed.*).

tish Guiana. The Coccinellid beetle *Megilla maculata* De Geer frequently preys on the young larvae, and the so-called Demerara Robin (*Leistes guianensis*) will also feed on them.

On sugar estates the usual method employed when a slight attack of this pest occurs is to pick them off the canes by hand and drop them into buckets containing kerosene and water. When efficiently carried out this is an effective measure, but the application of dry powdered arsenate of lead would give just as satisfactory results and would prove cheaper.

When it attacks rice in the nursery beds, flooding may be resorted to, as described for the control of the rice caterpillar.

As regards paragrass, the value of the crop hardly guarantees the application of control measures ; a field when badly attacked may be left till the caterpillars enter the chrysalis stage and then burnt off to prevent further infestation.

866 – **A New Sugarcane Aphis *(Aphis bituberculata)* in Louisiana.** — WILSON, H. F., in *Entomological News*. Vol. XXV, No. 7, pp. 298-299, plate XIII. Philadelphia, 1914.

The writer received in 1912 some specimens of an aphis which had been found on *Saccharum officinarum* in Louisiana (Audubon Park, New Orleans). Not having been able to indentify it with any other aphis found on sugarcane, he describes it as new to science under the name of *Aphis bituberculata*.

867 – **Eelworms Injuring Hops in Bavaria.** — WAGNER in *Praktische Blätter für Pflanzenschutz*, Year XII, Part 6, pp. 66-68, 1 fig. Stuttgart, 1914.

In August 1913 the writer observed at Pörnbach in a well cultivated seven-year-old hop garden a few dozen plants near each other which presented a very stunted growth. The hops were quite withered and worthless.

It has been ascertained that the mischief was due to the presence of eelworms — very probably *Tylenchus devastatrix* Kühn — on the rootlets. Eelworms had not previously been observed at Pörnbach, even on other crops.

868 – ***Godara comalis*, a Cabbage Moth, Attacking Turnips in Queensland.** — JARVIS, E., in *The Queensland Agricultural Journal*, New Series, Vol. I, Part 6, pp. 427-429, plate 62. Brisbane, 1914.

One of the least known cablage moths, *Godara comalis*, has recently manifested a decided liking for turnips, the caterpillars feeding freely on the leaves so as to leave only the skeleton.

This species is sometimes found in association with *Hellula undalis*, a notorius pest known as the cabbage webworm, which not only causes serious damage to this vegetable, but is destructive at times to turnips and other cultivated Crucifers.

With reference to control, prompt measures at the commencement of the season are of the utmost importance, since destruction of the first brood of moths will materially decrease the injurious action of succeeding generations. Arsenical sprays are of little use against larvae well established

among the heart leaves of big cabbages, but should be effective applied to young plants or to the foliage of turnips.

The writer does not believe that this pest has hitherto been recorded as attacking cabbage seed-beds, but if it should do so Bordeaux mixture sprayed upon seedlings whilst in the bed and when planted out should act as a deterrent.

It is advisable to destroy carefully all weeds, especially of Cruciferous plants, and any badly injured cabbages, and never to allow stumps with worthless leaves to remain in the field after the crop has been removed. Such refuse should be put in a heap and burnt without delay. Cultivating between cabbages at a time when the larvae are in the pupal stage would doubtless destroy many of them, and also improve the general condition of both crop and soil.

869 - **The Rose Beetle *(Adoretus vestitus)* and the Injury it Causes in the Samoan Islands.** — FRIEDERICHS, E., in *Zeitschrift für wissenschaftliche Insektenbiologie*, Vol. X, Part 2, pp. 41-47, figs. 1-6. Berlin-Schöneberg, 1914.

The writer gives a minute description of the larva, pupa and imago of *Adoretus vestitus* Boh., which is very abundant in the island of Upolu, where it is called " Rosenkäfer " by the German colonists, as the perfect insect attacks by preference rose leaves, which it riddles completely. The rose plants are often quite despoiled of their leaves and killed. The insect feeds also on larger leaves such as those of cacao, and in a characteristic manner, leaving only the outer edges and the ribs untouched. The writer recently observed many young cacao plants in a plantation destroyed by *Adoretus*. Even large trees were seriously injured by these insects. Other frequent host plants are *Coffea liberica*, *Hibiscus tiliaceus* (" fau " of the Samoans ; almost every plant has its leaves completely devoured), *Terminalia litoralis* (" talie " of the natives) and others.

The injury caused by these beetles, with the exception of that to roses (which have no economic importance in Samoa), has not hitherto been very severe ; the insect and the mischief that it does are, however, on the increase and perhaps before long it may become dangerous.

The eggs of *Adoretus* are unknown to the writer. The larvae when fully developed are about eight-tenths of an inch in length ; they are of a yellowish white and are found at all times and of all sizes on the roots of Gramineae and under rotting vegetable matter, especially in decomposing farmyard manure, from which it may be inferred that the insect multiplies all the year round. Before pupating, the larvae rest for a long time ; then they prepare, by means of a special secretion, a kind of cocoon of earth which protects them from their enemies. The larvae do not injure the roots of plants. Probably the insect has been introduced into the Samoan Islands (where it was first noticed about six years ago) in the larval stage by means of vegetable matter surrounded by earth. The adult insect is from 0.4 to 0.5 in. long ; its colour varies from yellowish to a brownish red. It lies hidden during the day and is therefore very rarely found ; it feeds and mates at night. If disturbed it allows itself to fall from the leaves. It appears in great numbers throughout the year.

It has been observed that it is always the small cacao trees not sheltered in any way which are killed by the insect, while those in the shade of other trees or surrounded by bananas, for instance, often remain uninjured. Roses have been protected by mosquito curtains being thrown over them at night and cacao nurseries might be equally protected by old fishing nets. Shaking the plants and collecting the adult insects has given only partial results, as new individuals keep on appearing. Spraying with various substances has prevented the beetle from devouring the leaves, but these have been damaged by the remedies used. Insectivorous birds or mammals ought to be introduced into Samoa to feed upon the larvae in the soil. Hitherto the attempts to infect *Adoretus* with the green muscardine fungus (*Metarrhizium Anisopliae*), which has been recently used in Samoa with very promising results against the larvae of *Oryctes rhinoceros*, the worst enemy of cacao, have failed. The writer will continue his researches in this direction.

RUGGERI ALFREDO, *gerente responsabile.*

FIRST PART.

ORIGINAL ARTICLES

The Present Status of the Cattle Industry in Canada

by

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Assistant Live Stock Commissioner.

According to the last Dominion Census held in 1911, there were in Canada at that time 6 533 436 cattle. The following table indicates how these are distributed by provinces as well as the comparative increase which has taken place during the last 40 years.

An examination of the above statistics, while making clear that there has been a regular and reasonable increase during the past fifty years in the cattle population of the country, reveals a somewhat anomalous situation as regards the proportionate development of the Eastern and Western areas of the Dominion. In Eastern Canada, production has barely held its own and particularly in the provinces of New Brunswick and Nova Scotia there has been a distinct falling off during the past two decades. On the other hand, Western Canada, including the prairie provinces and British Columbia, has made definite and satisfactory advancement.

The conditions causing this situation are not far to seek. The lure of free land has turned the tide of settlement westward, the movement of emigration being not only from across the Atlantic but as well from the rural districts of the Maritime provinces, Quebec and Ontario. The redistribution of population, following the opening for settlemnt of the extensive and fertile areas in the provinces west of the Great Lakes has had a very important bearing upon the development of the live stock industry.

A further feature, pertaining to the relative growth of urban and rural populations, should also be alluded to in this same connection. There has been, during the past ten years, in every province of Eastern Canada, with the exception of Quebec, a decrease in the rural population, while,

	1871	1881	1891	1901	1911
Prince Edward Island.					
Milch Cows	—	45 895	45 849	56 437	52 109
Other Cattle	—	44 827	45 846	56 342	68 287
Totals	—	90 722	91 695	112 779	120 396
Nova Scotia.					
Milch Cows	122 688	137 639	141 684	138 817	129 302
Other Cattle	151 279	187 964	183 088	177 357	158 122
Totals	273 967	325 603	324 772	316 174	287 424
New Brunswick.					
Milch Cows	83 220	103 965	106 649	111 084	108 532
Other Cattle	80 467	108 595	98 043	116 112	113 659
Totals	163 687	212 560	204 692	227 196	222 191
Quebec.					
Milch Cows	406 542	490 977	549 544	767 825	753 134
Other Cattle	376 920	539 356	419 768	598 044	697 860
Totals	783 462	1 030 333	969 312	1 365 869	1 450 994
Ontario.					
Milch Cows	638 759	782 243	876 167	1 065 763	1 032 979
Other Cattle	764 415	919 924	1 064 506	1 422 043	1 471 694
Totals	1 403 174	1 702 167	1 940 673	2 487 806	2 504 673
Manitoba.					
Milch Cows	—	20 355	82 712	141 481	155 337
Other Cattle	—	39 926	147 984	208 405	279 776
Totals	—	60 281	230 696	349 886	435 113
Saskatchewan.					
Milch Cows	—	—	—	—	181 146
Other Cattle	—	—	—	—	452 466
Totals	—	—	—	—	633 612
North-West Territory.					
Milch Cows	—	3 848	37 003	56 634	—
Other Cattle	—	9 024	194 824	212 145	—
Totals	—	12 872	231 827	268 779	—
Alberta.					
Milch Cows	—	—	—	46 101	147 687
Other Cattle	—	—	—	276 859	592 163
Totals	—	—	—	322 960	739 850
British Columbia.					
Milch Cows	—	10 878	17 504	24 535	33 953
Other Cattle	—	69 573	109 415	100 467	105 230
Totals	—	80 451	126 919	125 002	139 183
Dominion of Canada.					
Milch Cows	1 251 209	1 595 800	1 857 112	2 408 677	2 594 179
Other Cattle	1 373 081	1 919 189	2 263 474	3 167 774	3 939 257
Totals	2 624 290	3 514 989	4 120 586	5 576 451	6 533 436

for the same period, there has been a significant increase in the urban population. In Western Canada, however, there has been an increase of population in both rural and urban districts. The following table will be of considerable interest in making clear this comparison.

Rural and Urban population of Canada in 1911 *and* 1901 *by Provinces and the Increase in the decade.*

Provinces	Population 1911		Population 1901		Increase	
	Rural	Urban	Rural	Urban	Rural	Urban
Dominion total . .	3 925 502	3 281 141	3 349 516	2 021 799	+ 575 986	+ 1 259 342
Alberta	232 726	141 937	52 399	20 623	+ 180 327	+ 121 314
British Columbia .	188 796	203 684	88 478	90 179	+ 100 318	+ 113 505
Manitoba	255 249	200 365	184 738	70 473	+ 70 511	+ 129 892
New Brunswick . .	252 342	99 547	253 835	77 285	— 1 493	+ 22 262
Nova Scotia. . . .	306 210	186 128	330 191	129 383	— 23 981	+ 56 745
Ontario.	1 194 785	1 328 489	1 246 969	935 978	— 52 184	+ 392 511
Prince Edward I.	78 758	14 970	88 304	14 955	— 9 546	+ 15
Quebec	1 032 441	970 791	992 667	656 231	+ 39 774	+ 314 560
Saskatchewan . . .	361 067	131 365	73 729	17 550	+ 287 338	+ 113 815
Yukon	4 647	3 865	18 077	9 142	— 13 430	— 5 277
Northwest Territories	18 481	—	20 129	—	— 2 933	—

The table given above throws considerable light upon the relation existing between supply and demand with respect to the marketing of meat products in the Dominion. Reason is presented for the fact that during the past decade exports have fallen off and imports have increased, while within the past three or four years prices have advanced at an unprecedented rate. It now becomes clear that while the consuming centres have been extending in area and increasing in population, the producing areas have become depleted in population and potentially, for the present at least, not largely increased in extent. In explanation of this latter statement it should be remembered that, hitherto, grain growing and not stock raising has been the most prominent feature incident to the agricultural development of Western Canada and that the increase in the rural population of that part of the country has thus far resulted in an increased output of wheat, oats, barley and flax rather than in an appreciable extension of stock-breeding operations. Moreover, the influx of settlers has gradually entailed a systematic reduction of the prairie pasture and ranching areas, with a correspoding curtailment in the rearing of cattle under range conditions. Much of the land, therefore, which was formerly

devoted to cattle raising has, during recent years, been placed under cultivation and, in consequence, is not now producing its one-time quota of marketable animals. Mixed farming is, however, now rapidly gaining ground in Western Canada, particularly in the more northerly portions of the three prairie provinces, and this accounts for the fact that, despite the reduction in the range areas, the West has been able of late to appreciably increase its cattle stock. It would seem that a considerable extension of this movement may be confidently expected within the next few years, there having been already established there the foundations of a great cattle industry.

As casting additional light upon the present relative demand and supply of beef and beef products, reference should now be made to the changes which have taken place in our export and import trade during the past few years. The following table furnishes a great deal of useful information in this connection.

Canadian exports and imports of cattle and beef.

Year	Export cattle trade		Import cattle trade	
	Cattle Number	Beef Lbs.	Cattle Number	Beef Lbs.
1883	66 396	628 728	20 978	2 764 736
1893	107 224	356 106	1 851	5 599 113
1903	176 780	2 378 175	37 528	1 381 254
1909	162 945	1 571 585	2 601	1 306 607
1910	157 386	1 318 397	1 012	1 446 302
1911	124 923	974 411	3 044	1 170 649
1912	61 517	948 771	2 976	1 976 949
1913 (calendar yr.)	216 295	—	9 127	—

By way of comment upon the above figures it should be explained that the export trade of live cattle to the United Kingdom has practically ceased, notwithstanding the fact that this trade, for a considerable period, absorbed the best and heaviest cattle produced in either Eastern or Western Canada. The great lairages in London and Liverpool, built exclusively to handle American live cattle, now remain permanently empty. The markets of the United Kingdom have been forced to the conclusion that they can no longer draw their supplies from this continent.

As the table does not make it sufficiently clear, reference should be made, perhaps, to the peculiar situation which developed during 1913 in connection with the exportation of cattle to the United States. Practically all of the cattle exported, as credited to that year, went across the American border. Such an anomalous development, however, has been significant of only one thing; that, with the removal of the American tariff

higher prices could be realized in the United States than in this country. The liquidation of Canadian stock continued until an equilibrium was reached, the movement further accentuating the already marked scarcity of marketable cattle on this side of the border. Never in our statistical history have prices attained so high a figure, either for cattle on the hoof or for meat in the butcher shops, as has been the case this year.

As regards prices, market returns and the movement of meat within the country, the average market returns for the past years in the case of choice butcher cattle sold in Toronto have been as follows: — In 1911, $ 5.76 - $ 6.10 per cwt; in 1912, $ 6.92 - $ 7.17 per cwt; and in 1913, $ 6.94 - $ 7.23 per cwt. These figures tell their own story and the facts which they suggest are fully featured in the scarcity of cattle in the country. Marketings on the whole have increased during the past few years. Particularly is this true in the case of calves, there being 112 053 head marketed at Toronto, Montreal and Winnipeg in 1909, as compared with 162 539 in 1913. It can scarcely be said, however, that the marketings of 1913 represent normal conditions, particularly in view of the large exportation to the United States.

Whereas formerly thousands upon thousands of cattle were received at the Toronto and Montreal markets for feeding and export purposes, those so received in 1913 did not total more than 2 239 head. The output of Alberta and Saskatchewan, which at one time went forward to Winnipeg, is now either consumed locally or, particularly in the case of Alberta, shipped into British Columbia. During the month of February 1913 three-quarters of a million pounds of beef were shipped from Ontario and one-quarter of a million pounds from Alberta to Canada's most westerly province. Even the prairie provinces are taking some supplies from Eastern Canada, partly through the importation of meat, but chiefly in the way of carloads of breeding cattle. In the latter movement British Columbia has also largely participated. As regards Eastern Canada, the Maritime provinces, particularly Nova Scotia, are now drawing freely from Ontario and Quebec. Very recently their receipts ran up to nearly a million pounds per month. The larger cities have each taken their quota, but fully a quarter of the amount went direct to Sydney, North Sydney and Sydney Mines in Cape Breton, where there are large manufactories of iron and steel.

A review of the facts already presented point to the one conclusion, that the country, owing to an inadequate supply, has been forced to a curtailment of meat consumption. That there is a remarkable shortage of cattle and that there has been a decrease in the per capita consumption of meat is borne out by an analysis of the figures. Notwithstanding her large area and great agricultural resources, Canada, in so far as live stock products are concerned, has now ceased, except upon occasion, to be an exporting country and has already been compelled to import considerable quantities of foreign meat. The present situation, it must be admitted, is largely consequent upon the nature of our economic development, but the causes producing it are steadily calling into being their own remedies. Everywhere throughout the country there is already on foot a comprehen-

sive movement toward the conservation of breeding stock and an extension of breeding operations. With breeding cattle in demand, with fewer calves going to the shambles and with a steadily growing domestic market, it may confidently be predicted that we are about to enter upon a period of general progress and expansion.

Up to this point, we have chiefly comprehended in the discussion the business of beef making. Special reference should now be made to the position occupied by the business of dairying in the development of cattle husbandry in Canada. There are, particularly in the provinces east of the Great Lakes, certain well defined areas where dairying and dairy cattle have for generations been directly associated with the agricultural operations of the people. In Nova Scotia and New Brunswick the Guernsey and Jersey breeds have predominated ; in Quebec, the French Canadian and Ayrshire, while in the dairy sections of Ontario, the Ayrshire and Holstein have attained the preference. In certain districts of the provinces mentioned, dairying has been, for many years, almost exclusively followed and it should now be pointed out that recently, particularly in the province of Ontario and in Western Canada, dairying as an industry has made very rapid progress, its devlopment paralleling, in part at least, the increase in our urban population. Formerly the making of cheese and butter constituted the most important part of the business. Now, on the other hand, more remunerative avenues have opened up in connection with the shipment of milk to our more important towns and cities, and with the supplying of cream to the ice cream trade and for export to the United States.

It is generally admitted that the dairy cow yields a larger economic return than does the beef steer and that milk as a wholesome, nutritious food product is cheaper than meat. While, therefore, there are large areas of the Dominion suitable only for beef raising, still, the attention of the farming public both East and West is being directed to the profit-earning ability of the cow that will produce milk.

It would almost appear that the successful future of the beef industry in this country is dependent upon the ability of the breeders of pure-bred beef stock to combine in the cattle they produce the capacity for reasonable milk production, with an inherited tendency to thick fleshing and to early maturity.

It would be of interest in an article of this kind to outline in some detail the progress and development of breeding operations in improving the type and quality of our cattle through the use of imported and home-bred pedigreed stock. The position of the Dominion, however, is now so well attested and so firmly established by the laurels won by Canadian-bred animals at International Exhibitions, where both beef and dairy breeds have been represented, as to make it scarcely worth while to dwell upon this feature of the industry. Certain of the older sections of the Dominion have long been recognized as amongst the most important and most dependable of live stock breeding grounds upon the North American Continent. Several factors have contributed to the attainment of this position, notable

amongst which in brief summary, may be mentioned: — the importation through a long period of years of carefully selected stock from the best herds of Great Britain; the climate and the character of the food which have developed hardiness, quality and finish; the competitive rivalry amongst breeders as encouraged by the great national and international exhibitions; the organization of district breeders' clubs, and the institution of the Canadian Record of Performance. Comment upon these factors is unnecessary except that it may be explained that the Canadian Record of Performance was initiated by the Federal Department of Agriculture in the interests of the breeders of dairy cattle and consists in the testing at reasonable intervals of the milk and butter-fat yield of cows whose owners apply therefor under the conditions laid down by the Department. The information which is rendered available by these records provides a standard for the selection, particularly of pure-bred sires, and its use is steadily leading to an improvement in breeding practice.

One other factor is yet to be alluded to: It is, the nationalization of the Canadian Records of pedigreed stock, which has not only made possible a systematization of our national live stock records, but has, as well, furthered and advanced in a very direct manner the business of the pure-bred stockman and the cattle industry of the country.

Until the year 1900 all the Live Stock Records in Canada were conducted by the Provincial Departments of Agriculture or by breed associations more or less provincial in character and scope. Although the most important record associations had their origin in the Province of Ontario, books of record were also established in Quebec, the North West Territories and in each of the Maritime provinces. This multiplicity of records, without uniform standards of registration, proved a source of confusion and expense to breeders and farmers and a hinderance to interprovincial and export trade. The first step taken to improve the existing situation was the passage in 1900 of an Act respecting the Incorporation of Live Stock Record Associations. Leading Record Associations promptly availed themselves of this Act and secured incorporation under Dominion charters within the next few months.

The establishing of a national system of records was the subject of discussion at many breeders' meetings up to the year 1904, when a General Convention of Live Stock Breeders from all parts of Canada was called at the instance of the Minister of Agriculture. At this Convention, committees were appointed to work out the details of a scheme providing for the nationalization of Canadian Live Stock Records, and in April of the following year another convention of delegates from each of the Live Stock Record Associations was held in Ottawa and a National Record Board established. The National Record Board is composed of representatives elected by the Boards of Directors of the various breed associations on the basis of two persons for every 100 members or under, and one additional representative for each 500 members.

It is to these men, forming the National Record Board, that the breed associations delegate the work of carrying on the National Record Office

to their mutual advantage, but with due regard to the Constitution and rules of entry of each association as laid down in the Dominion charter under which it is incorporated.

The Record Board meets annually and discusses and decides the larger questions connected with record matters. In order that the detail of registration may be efficiently looked after, an Executive Committee is elected by the Board, one man representing each class of stock as follows: — Heavy Horses, Light Horses, Beef Cattle, Dairy Cattle, Sheep and Swine. These representatives, presided over by the Chairman of the National Record Board, with a Secretary-Treasurer, constitute what is called the Record Committee. This Committee meets at sufficiently frequent intervals to look after the work entrusted to them by the Record Board in the matter of registration, which includes management of the National Records Office. This office is placed in charge of an Accountant, who is also Secretary-Treasurer of the Board and has full supervision of the several registrars and clerks. It will be seen that the work of registration is entirely under the control of the breeders themselves through their Breed Associations, Record Board, Record Committee, Accountant and Registrars. The Department of Agriculture, however, furnishes office accomodation and equipment, including stationery and other supplies, and assumes a further responsibility in connection with the work of the Records Office, to the extent of guaranteeing the authenticity of the certificates issued. That is to say, the registration certificates, after being prepared in accordance with the office records and carefully checked by the registrars, are handed over, along with the application forms received from the breeder, to an officer of the Department, who examines the certificates and compares them with the breeders' applications. If found correct, the certificates are approved by this officer, on behalf of the Minister, under his own hand and the seal of the Department.

Regarding the disposition of fees received, they are all deposited in a bank to the credit of the association for which they are sent. These monies are payable only to the order of each representative association through its officers. It is, therefore apparent that the Record Committee, after depositing these funds through the Accountant, has no further control of them.

To finance the affairs of the office, a monthly levy is made by the Record Committee on all self-sustaining associations. The amount charged for each association is based on the charges for the previous year. If the levies prove too large or too small, adjustment is made at the end of the fiscal year. The expenses of the Associations on which levy is not made are provided from a grant given by the Department of Agriculture to the Record Committee. In doing this the Department is carrying out an agreement to assist new records. The monies accruing to an association not expended as above noted, are, subject to the order of the association, to be used in meeting the expenses of officers and directors for the purposes of publicity, or in such other ways as are provided in Section 15 of the Live Stock Pedigree Act.

It may be added that the recording of live stock under the present system is found to work very satisfactorily. The methods now followed have eliminated not only the control of records by close corporations but the possibility of the occurrence of those complications inseparable from the existence of multiplicity of records in the same country. The recording of live stock is characterized by accuracy, promptness and economy of administration, while Canadian Records are now recognized as official not only throughout the Dominion but in other countries as well.

With the single exception of the Canadian Holstein Friesian Association, which has a Dominion charter but has not yet seen fit to co-operate with the other Associations, all Record Associations in the Dominion are operated under the National Records System.

By way of general information with respect to the strength and standing of the various pure-bred Cattle Breeders' Associations in the Dominion, the following statement, setting forth the registrations for the year 1913 and the total membership to date, is submitted :

Name of Association	Registrations 1913	Membership 1913
Dominion Shorthorn Breeders' Association	9 046	2 051
Canadian Ayrshire Breeders' »	3 258	1 084
Canadian Hereford Breeders' »	1 362	301
Canadian Jersey Cattle Club	1 155	267
North American Galloway Association	23	22
Canadian Aberdeen Angus »	831	179
Canadian Guernsey Breeders' »	79	31
French Canadian Cattle Breeders' Association	334	172
Canadian Red Polled Association	90	28
Holstein-Friesian Association of Canada	6 815	1 646

The Crisis in Italian Sericulture and the Measures for Averting It

by

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The production of cocoons and the silk industry are among the greatest sources of revenue of the Kingdom of Italy. The former ranges between six and eight millions sterling per annum and the latter supplies an export trade which at present amounts to about 20 millions, but which some years ago reached 28 millions. Both have very ancient traditions, for the rearing of silkworms was introduced into Calabria by the Byzantine Greeks in the

tenth or eleventh century; the Norman kings extended it to Sicily and fostered the silk industry to such an extent that between the twelfth and the thirteenth centuries Catanzaro, Reggio and Messina had famous factories producing velvets, brocades and other silken goods. Later, both silkworm rearing and the silk industry spread northwards and flourished there also. Indeed the chief characters of the greatest Italian historical novel — the "Promessi Sposi" of Alessandro Manzoni — are two humble silk-weavers of the year 1630. In the eighteenth and nineteenth centuries silkworm rearing and the industry connected with it continued their progress throughout the Valley of the Po (while they declined in the south of the country), and underwent a considerable increase owing to the excellence of the product, unequalled by that of any other country. The reeling, spinning and weaving of silk and the silk by-products industry, notwithstanding serious obstacles and several financial disasters, established themselves firmly, especially in Liguria, Piedmont and Lombardy; Como and Milan came to be as important centres of the silk trade as Lyons, Zurich or Crefeld. The service known in Italian as "condizionatura" or in French "passage à la condition" of silk, that is the deposit of the bales of silk in certain warehouses, whence samples are taken with a view to investigating the quality of the silk and determining the use to which the raw product is to be put, has attained and maintains in Milan much greater proportions than in the other silk centres of Europe.

These results are all the more worthy of consideration as they have been attained in spite of ever increasing difficulties, especially the fall in prices, the increase of the cost of production, and the customs' duties levied by the countries importing Italian silk fabrics. The fall in prices from 1*s* 6*d* or 1*s* 9*d* to less than 1*s* per lb. was caused by the competition of Asiatic silks, which, though much inferior to Italian silks, beat them through their lower price. Further, while the produce exported more than trebled in a quarter of a century, as the table below shows, since 1890 the wages of agricultural and industrial labour have increased by fully 50 per cent. Against the effects of this increase of cost, both the silkworm rearers and the factories opposed continued improvements in the yield and technique of their output. Lastly the silk substitutes appeared on the market: artificial silk, mercerized cotton, *viscose* and the like. Though these only take the place of silk for special purposes they contribute to reduce the demand and consumption.

The ever increasing arrivals of Chinese and Japanese silks on the European and American markets have altered the relative position of Italy in the world's market as shown by the figures in Table I. From them also it is easy to judge to what an extraordinary degree the consumption of silk has increased, notwithstanding the increased production of substitutes (1).

(1) These data have been collected by the "Union des Marchands de Soie" of Lyons, and published in the *Bollettino di legislazione commerciale e doganale*, Part II, 1890, p. 614, 1903, p. 388; 1913, p. 1034.

TABLE I. — *Average yearly production of silk (in metric tons).*

Country	1885-1889	1899-1903	1907-1911	1912
Italy	3 113	4 272	4 190	4 105
France	669	599	542	505
Spain	66	81	82	78
Austria-Hungary	245	300	352	294
Total Europe	4 093	5 252	5 175	4 982
Levant and Central Asia	667	2 083	2 903	2 233
Exports from Shanghai	2 549	4 598	3 222	6 400
» Canton	1 149	2 153	2 258	2 260
» Yokohama	1 928	4 309	8 124	10 867
» Calcutta	553	290	261	133
Total of the whole world	10 939	18 685	23 943	26 915

The ratios between the figures for the period 1885-1889 and those given above for 1907-11 show how the individual States have modified their output :

Italy	from 1 to 1.35
France	» » » 0.80
Spain	» » » 1.24
Austria-Hungary	» » » 1.43
Levant and Central Asia	» » » 4.36
Exports from :	
Shanghai	» » » 2.04
Canton	» » » 1.96
Yokohama	» » » 4.21
Calcutta	» » » 0.47

While the European and American world increased its demand for silk by 13 000 metric tons, Europe contributed only about 1000 tons, the remaining 12 000 being supplied by China and Japan and forming the basis of the great business and trade activity of the last decade in the Far East. Italy's contribution, which between 1885 and 1889 amounted to 28.4 per cent. of the total silk, fell to 17.3 per cent. in 1907-11. According to our statistics the production of fresh cocoons, which was from 38 000 to 40 000 metric tons between 1880 and 1889, reached 57 300 tons in 1900 to 1904 and in the succeeding years fell to the following figures :

Production of cocons in Italy from 1905 *to* 1913 (*in metric tons*).

Year	Tons	Year	Tons
1905	51 940	1910	47 964
1906	53 838	1911	41 951
1907	57 058	1912	47 470
1908	53 193	1913	38 490
1909	50 760		

The prices of the raw material and of silk were in keeping with this trend of affairs. Up to 1875 they were high, as much as 1*s* 6*d*, 1*s* 9*d* and 2*s* 2*d* per pound of cocoons, and sometimes even 36*s* per lb. of silk; after 1880 they varied as follows:

Periods and years	Prices at Milan, per lb. in gold			
	Fresh cocoons		Raw silk (sublime $^{10}/_{12}$ brand)	
	s	*d*	*s*	*d*
1880–1884	1	5	19	7.4
1885–1889	1	2.8	17	9
1890–1894	1	2.4	17	9.4
1895–1899	0	9.8	16	0.6
1900–1904	1	0.8	16	6.3
1905–1909	1	2.9	17	6.8
1910	0	11.6	15	3.6
1911	1	0.3	15	3.6
1912	0	10.5	14	9.1
1913	1	1.6	17	1.2

After 1900 the highest prices of cocoons were in 1907, namely 1*s* 5 $^1/_2$ *d* with the raw silk at 18*s* 2 $^1/_4$ *d*; but in 1908 and 1909 the former fell to 1*s* 1*d* and 1*s* 3*d* and the latter to 15*s* 8*d* and 16*s* 6 $^3/_4$ *d*.

At the same time, this fall in prices, due to competition from China and Japan, allowed the world's consumption to quadruple itself in thirty years, as the use of silk extended to all classes; this gave a fresh impetus to the industry. But the same causes produced difficulties for the Italian industry and rearing, especially in conjunction with the increased cost of labour. The rearers and manufacturers fought against these difficulties and held out for over ten years, so that up to 1907-08 the increase in the production of cocoons kept pace with the increase in the silk trade shown by the following figures (in millions of francs):

Periods and years	Imports	Exports
1891–1895	114.6	321.8
1896–1900	147.3	410.9
1901–1905	218.5	555.6
1906	250.5	683.7
1907	314.0	710.2
1908	242.5	553.4
1909	236.3	615.6
1910	269.5	583.1
1911	259.7	505.7
1912	212.8	549.5
1913	200.3	497.1

The data on the commercial activity also show an *optimum* in the period 1905-1907, in which the imports averaged about £10 000 000 per annum and the exports about £26 600 000. But from then up to 1913 there is a fall of about £8 800 000 in the total trade, which is a very eloquent index of the difficulties against which silkworm rearing and the silk industry have to contend. They have had to struggle for several years against low prices and sometimes even to work at a loss and to resist the formidable competition previously mentioned. This explains the recent decrease of the home poduction, which in its turn is a source of serious embarassment to to the industry, depriving it of the exceptionally good raw material which alone can supply the classical raw silks for the trade and the first class fabrics of the Milan and Como looms. It is one of the chief causes of the decreased exports, which concern more raw silk than the fabrics, as the deficiency in raw material from the country cannot be replaced by Asiatic cocoons.

It will thus be readily understood that all engaged in the silk industry follow with the greatest interest the efforts made to increase silkworm breeding in Italy and especially in the south, where it was once flourishing. During the last twenty years the Italian bibliography on agriculture, silkworms and silk is full of works which treat of this increase and aim at furthering the planting of mulberries and raising worms in Southern Italy. It may be assumed that this object will be attained, for the history of Italian sericulture shows that it has contended with and overcome more than one serious obstacle in the past.

Thus in 1850-55 it received a severe blow from the invasion of pébrine, which carried off half the worms and almost annihilated silkworm breeding in the South . At this time the producers of silkworm eggs of the north of Italy had resort first to Turkey and Anatolia, then to Persia, Turkestan and China, and lastly to Japan, thus saving the national silkworm breeding and silk industry. Meanwhile distinguished scientists investigated the causes of the diseases of worms; Dubini had already discovered *Botrytis bassiana*, the cause of muscadine, in 1832, and later Emilio Cornalia discovered the corpuscles of pébrine and proved the herditary transmission of the disease. Pasteur in France and Gaetano Cantoni in Italy, availing themselves of the discovery, invented the cellular method of preparing silkworm eggs with the aid of microscopical examination, thus allowing the reconstitution of the old Italian breeds. This gave rise to a new industry, the preparation of eggs free from pébrine. At the same time the technique of spinning and weaving made wonderful progress, the industry of silk by- products was founded and our silk fabrics steadily gained ground in foreign markets.

The State on its part favoured the movement by founding the Padova Silkworm Breeding Station under the direction of the famous silkworm expert Verson, and silkworm observatories; it arranged for instruction on the subject to be given in agricultural schools, as well as by the travelling lecturers ; it held special competitions, founded schools of weaving and silk dyeing at Como, and assisted industrial and technical educa-

tion. In addition to all this, private initiative joined in the work, chiefly by instituting cooperative esiccators, that is establishments in which the cocoons of the agricultural members are suffocated, dried and stored, thus avoiding the necessity for selling the fresh produce within a few days (1). A private society, the " Anonima Cooperativa per la Stagionatura delle Sete " of Milan, founded and kept up by itself the laboratory for the study of silks, from which very valuable contributions to the technique of the industry have been and are being made.

Altogether few Italian sources of production and of industrial activity have been the object of so much study and free and successful initiative as silkworm raising and the silk industry.

Among the difficulties mentioned above, must be included a parasite of the mulberry, *Diaspis pentagona*, a most injurious scale insect from Japan which invaded the mulberry plantations in 1890. For its control it became necessary to enact laws rendering obligatory the use of certain insecticide emulsions, but the work of scientists was still more beneficial. Prof. Antonio Berlese discovered an entomophagous parasite, *Prospaltella berlesei*, which now successfully controls the Japanese fruit scale. Meanwhile, however, in many localities numbers of mulberries had perished or were in such a bad state as to induce the farmers, tired with the struggle against so many adverse conditions, to cut them down.

The above-mentioned efforts to improve the conditions of sericulture were not sufficient, in view of the many difficulties which beset it, to attain their aim, and the Government had naturally to take the matter into serious consideration, owing to the great interests involved. After several measures, in January 1907 the Government decided upon an enquiry by a Commission under the presidency first of the Hon. L. Luzzatti and then by the Hon. Senator Cavasola, at present Minister of Agriculture. The Commission presented its report in 1910; this dealt with the conditions of Italian sericulture, the causes of its depressed state and the measures to be adopted. It is naturally impossible to give a résumé of it here; it will be enough to say that the Commission declared in its conclusions that the greatest evil which afflicted the silk industry was the want of organization, and it proposed the foundation of a Silk Institute as an independent body for the object of furthering the progress and the improvement of sericulture. Beside this measure, it recommended suitable provisions for credit, for the rail way tariffs, for the carriage of cocoons, silk and silk fabrics, and for the customs tariffs, with the object of facilitating the importation of raw materials required by the industry. It advocated also the extension of instruction in silkworm rearing and mulberry growing, especially in the colleges at Milan, Perugia and Portici. It demanded especially that the State should aim at obtaining *an increase and a progressive improvement in the production of national raw material, so as to supply completely the Italian*

(1) One of the most important esiccators is that of Cremona, which was founded chiefly by the exertions of Prof. Antonio Sansone, then director of the travelling professorship at Cremona and now Director-general of Forests.

factories and to keep up the character of Italian goods, which cannot be given by the raw material of other countries. Lastly the Commission asked that a complete and accurate study be made of the foreign silk trade and industry. The proposal of the foundation of the Silk Institute was not, however, accepted by Parliament, which nominated a Council for the Silk Interest, allotting to the Ministry of Agriculture £48 000 per annum for the above-mentioned objects, including the sending of special delegates to the East, to some countries in Europe and to New York, with the object of keeping in touch with the trade in raw material and in silken fabrics. The above sum was distributed as follows: For promoting silkworm rearing, mulberry growing, studies on silk, foundation of cooperative associations, etc., £20 000 and £4 000 in the financial year 1912-13. For the intelligence service and statistics £4 000. For the establishment of mulberry groves and distribution of mulberry trees, prizes to agricultural societies and farmers, control of *Diaspis*, etc., £10 000. For the increase of the endowment of the Como school of silk industry, for the new station of Ascoli, for the increase to the contribution to the Padua Station and for the three chairs at Milan, Portici and Perugia, £6 000. For scholarships to special courses of silkworm rearing at the above schools and other forms of propaganda, £4000; for increased subventions to travelling lectureships, £4 000. Lastly, for the first cost of the plant of the newly founded institutions and chairs and for the increase of the plant of the already existing ones £10 000.

The Silk Council was definitely constituted in July 1912 and has now actively entered upon its labours. It has appointed technical delegates in China, Japan, New York and other localities. It has turned its attention to the furtherance of professional instruction and provided for the encouragement of mulberry growing and silkworm rearing in all the regions of Italy; special attention has been paid to the south, which used to produce and still produces cocoons yielding abundance of good silk, notwithstanding the imperfections in the technique of managing the worms. During the 1914 season the Council started the publication of a Bulletin containing information on the cocoon crop in Italy and abroad and on every subject likely to interest the silk market.

The Ministry of Agriculture in its turn, availing itself of schools, travelling lectureships and other kindred institutions and of the above-mentioned funds, has begun a liberal distribution of mulberry trees and of silkworm eggs; it has organized special courses of instruction and has encouraged a number of breeders with an ample distribution of suitable instructions. Among these, special stress is laid on those which tend to teach the methods of diminishing expenses and consequently the cost of mulberry leaves and of cocoons.

As for the former, it has been recognized as advantageous in many instances to replace standard mulberry trees by hedges, low pollards, and so-called mulberry meadows, a kind of coppice which is cut every year and which renders the collection of the leaves much less expensive. In rearing, the breeders are advised, instead of feeding the worms on detached leaves, to give them whole shoots or twigs, as has been practised for a long time past

in Venetia. As regards the lack of housing, especially in the South, it has been shown that the Persian sheds or *tilimbars* are very convenient; these are built of poles and branches of trees at the beginning of the season and are dismounted as soon as the cocoons are gathered. Several tests of the system, especially those carried out at the Portici Agricultural College by Prof. Gustavo Leonardi, have demonstrated its superiority over other systems and its economy, especially under climates favourable to the worms like that of the South of Italy.

The above-mentioned law has provided for the greater and permanent spread of instruction and experimentation by founding a second Silkworm Rearing Station at Ascoli and three new chairs of silkworm rearing and mulberry growing at the Milan, Perugia and Portici Colleges. Many of these institutions are already in full work, and others will soon be founded; with them the whole series of measures for the attainment of the objects above-mentioned will be completed. The Divisions of Industry and Agriculture are actively devoting themselves to the work, whilst the Silk Council in its turn contributes opportune suggestions and expresses the real conditions and requirements of the country. Everything encourages us to hope that two of the most ancient and important sources of wealth, increased and strengthened by their own activity without artificial help and fiscal protection, will soon resume the place they once occupied in Italian public economy.

SECOND PART.

ABSTRACTS

AGRICULTURAL INTELLIGENCE

GENERAL INFORMATION.

DEVELOPMENT OF AGRICULTURE IN DIFFERENT COUNTRIES

870 – **Agriculture in Sweden..** — *Sweden, Historical and Statistical Handbook*, published for the Government by G. GUINCHARD ; second part : *Industries*, pp. 29-232. Stockholm, 1913.

In the year 1910, out of the 5 522 000 inhabitants of Sweden, 2 663 000 or 48.23 per cent., were occupied in agricultural pursuits ; in 1900 the percentage was 53.67 and in 1870, 71.87. Since 1880, in spite of the steady increase of the population, there has been also an absolute decrease in the agricultural population which then numbered 3 078 000 persons.

The cultivated area of the country was divided in 1911 among 359 871 farms, with an average area of about 25 acres under cultivation. The size of the farms has a very wide range. In the official statistics the groups according to size are as follows :

Size-group	Relative number
Up to 5 acres	25 per cent
5 to 50 »	64 »
50 to 250 »	10 »
over 250 »	1 »

As regards the area of cultivated land, small farms up to 25 acres and large ones over 125 acres each account for about ¼ of the total, the other half being occupied by the medium-sized ones. The extensive plains with fertile loam and clay soils in Central and Southern Sweden have relatively many large farms, while small farms are prevalent in the higher or hilly districts in the west and north of the country, on sandy and gravelly soils, where the cultivated land is cut up by mountains, woods and moors.

In general in Sweden, farmers own the land they farm ; in 1911 only a little over 14 per cent. of the whole number of farms were rented. Among the smaller farms renting is particularly uncommon (10 and 13 per cent. in the two smaller size-groups), while in the two groups of larger farms, with over 50 and over 250 acres, it is more frequent (31 and 35 per cent.).

In 1911 the total area of the country, 101 566 950 acres, was divided as follows :

Fields and gardens	9 144 700	acres or	9 per cent.
Meadows	3 226 325	»	3.2 »
Woods	52 828 600	»	52.0 »
Other descriptions	36 367 325	»	35.8 »

The arable area of Sweden has quadrupled in the last century. Table I shows the changes which took place in the areas occupied by the various crops between 1865 and 1911 :

TABLE I. — *Area under chief crops in* 1865 *and* 1911.

	1865	1911	1865	1911
	acres	acres	%	%
Cereals	2 908 500	4 141 600	50.5	45.9
Forage crops	1 569 200	3 355 800	27.2	37.1
Root crops	333 600	635 100	5.8	7.0
Other crops	51 900	7 400	0.9	0.1
Fallow	902 000	892 100	15.6	9.9
Total	5 765 200	9 032 000	100.0	100.0

The relative areas under the various kinds of cereals have changed considerably in the course of time ; barley, which was formerly the cereal most grown, has gradually lost importance, with the exception of Upper Norrland where it takes preference to other grain on account of its earlier ripening. As breadstuff barley has been chiefly replaced by rye; at the beginning of the 19th century the quantity of barley and rye harvested was about equal, while at the end of the century the rye crop was nearly twice the barley. Of late years the area under wheat has grown steadily, without however ceasing to hold the lowest place among the four leading cereals both for area and total yield. Oats have gained most of all in importance, now occupying almost half the area under cereals in the country; the crop is equal to that of barley, rye and wheat together, besides which, the bulk of the increasingly grown mixed grain is oats.

Of less importance in area occupied and in value are pulse crops (peas, beans, and vetches) and buckwheat, which is now grown only to a limited extent in the poorest sandy regions of Schonen.

With the increase in area under cultivation an increase of yield per acre has also taken place: it is due to improvements of the land, more

TABLE II. — *Area and yield of grain and pulse crops.*

Period	Total	Whea	Rye	Barley	Oats	Mixed grain	Pulse
			Area (in acres).				
1801–1820*	1 364 300	37 450	444 750	397 750	280 500	142 100	61 750
1821–1840*	1 789 850	53 900	583 200	463 300	375 600	202 600	111 250
1841–1860*	2 251 250	82 250	722 750	519 000	559 700	231 650	135 900
1861–1880*	3 187 580	143 927	877 382	556 492	1 275 241	198 638	135 900
1881–1890*	3 869 790	180 144	940 678	557 285	1 816 181	235 908	139 595
1891–1900*	4 170 709	179 356	1 001 475	542 999	2 024 808	296 369	125 702
1901–1905*	4 226 116	200 721	1 015 123	527 718	2 037 934	338 287	106 333
1906–1910*	4 176 192	226 302	1 002 152	476 034	1 987 278	383 227	101 198
1911	4 142 411	250 764	988 803	446 133	1 951 862	403 871	100 978
			*Yield (in metric tons)***.				
1801–1810*	620 700	16 200	195 000	200 000	120 000	64 000	25 500
1811–1820*	691 800	19 800	224 000	220 000	130 000	70 000	28 000
1821–1830*	813 200	30 000	280 000	230 000	140 000	84 200	49 000
1831–1840*	864 400	35 000	315 000	225 000	155 000	86 900	47 500
1841–1850*	1 029 000	43 000	347 000	270 000	1 94 000	110 000	65 000
1851–1860*	1 354 500	62 000	455 000	308 000	348 000	118 500	63 000
1861–1870*	1 540 000	70 000	455 000	300 000	560 000	101 000	54 000
1871–1880*	1 892 602	91 400	495 200	341 754	773 632	113 931	76 685
1881–1890*	2 138 217	101 800	526 700	336 155	960 467	140 115	72 980
1891–1900*	2 342 900	123 300	580 600	314 500	1 074 800	184 300	65 400
1901–1905*	2 138 587	136 177	555 037	282 959	926 365	195 902	42 146
1906–1910*	2 539 203	191 890	593 865	299 629	1 123 228	276 951	53 639
1911	2 477 803	217 844	592 949	289 401	1 039 540	284 394	53 675

*Yearly average for the period.
** One metric ton = 0.9842 English ton, or 1.10231 short ton.

TABLE III. — *Importation and exportat*

	Wheat, whole and milled			Rye, whole and milled		
	Import	Export	Excess of import	Import	Export	Excess of impor
1816–1820.	1 505.7	129.7	— 1 376.0	16 098.7	114.5	15 98
1821–1840.	159.5	794.2	+ 634.7	4 330.7	1 246.6	— 3 08
1841–1860.	2 454.9	3 662.7	+ 1 209.8	13 343.8	13 109.1	— 23
1861–1880.	27 087.3	10 137.6	— 16 949.7	106 274.1	3995.9	— 102 27
1881–1890.	83 796.6	6 851.8	— 76 944.8	173 502.8	3096.1	— 170 40
1891–1900.	146 558.0	1 151.8	— 145 406.2	114 212.1	2324.4	— 111 88
1901–1910.	207 102.5	180.9	— 206 921.6	94 438.1	4844.3	— 89 59
1911.	181 740.5	829.9	— 180 910.6	52 805.6	1473.0	— 51 33
1912.	179 860.0	795.3	— 179 064.7	116 762.8	435.0	— 116 32

abundant and suitable manuring, more thorough tillage, and the introduction of a more intensive rotation. The changes which have taken place in the acreage and yield of the various cereals and pulse crops since 1800 are shown in Table II.

Notwithstanding the increase in the production of grain in Sweden, namely from 598 lbs. per inhabitant at the beginning of the 19th century to 1 045 lbs. at present, among which breadstuffs figure for 205 and 315 lbs. respectively, a good deal of the constantly increasing consumption has to be met by importation.

In most of the twenties of last century the breadstuffs (wheat, rye and barley) harvested were sufficient for the wants of the country and soon an increasing export trade began, at first only with oats, but in the forties with barley, rye and wheat. In 1860, however, most of the exports ceased and the importation of wheat and rye in constantly larger quantities set in ; up to the middle of the eighties this was partly balanced by the exportation of oats, but after that time this also began to slacken, owing to the rising demands of the developing animal husbandry ; the result is that since 1902 the imports have been in excess of the exports by 2 to 3 millions sterling per annum. The condition of the trade is shown in Table III.

The following root crops besides potatoes are grown in Sweden : beets and mangolds, Swedes, turnips and parsnips. Between 1901 and 1910 about 1 450 100 tons of potatoes were grown yearly on 378 693 acres , this gives 614 lbs. per inhabitant, which is not much below the average figure for the west of Europe, namely 682 lbs.; deducting the seed (or about 10 cwt. per acre) there remains available for consumption 535 lbs. per inhabitant. Every year about 100 000 tons are used by the distilleries.

cereals (in metric tons).

Barley				Oats			
Import	Export	Excess of import		Import	Export	Excess of import	
6 082.6	2 07.9	—	5 874.7	521.4	430.8	—	90.6
2 919.5	1 647.1	—	1 272.4	597.3	2 790.0	+	2 192.7
2 129.3	12 907.3	+	10 778.0	110.4	28 647.9	+	28 537.5
6 371.5	29 663.1	+	23 291.6	541.1	189 174.0	+	188 632.9
8 033.0	23 146.7	+	15 513.7	2 930.7	197 710.0	+	194 779.3
6 235.9	2 023.6	—	4 212.3	11 773.5	87 899.1	+	76 125.6
2 487.1	87.1	—	2 400.0	69 052.8	9 021.8	—	60 031.0
1 279.5	5 379.5	+	4 100.0	102 051.9	28 091.8	—	73 960.1
6.1	3277.4	+	3 271.3	97 288.8	5 236.8	—	92 052.0

The area under sugar-beets has increased from about 45 000 acres in the mid eighties of last century to 75 000 acres in 1911; the average crop for the period 1901-10 was 8 130 000 tons, or 11 tons per acre. The sugar content has steadily increased, the yield of unrefined sugar having risen from 6.6 per cent. in 1870 to 15.72 in 1911.

Forage crops were grown in 1911 on 3 355 227 acres, or 37.1 per cent. of the cultivable land. The forage plants most commonly grown are timothy and red and alsike clovers. The yield of grass leys is, according to official statistics, about 20 to 28 cwt. per acre, making altogether between 3 and 4 million tons; to this must be added the hay from natural meadows, at 8 or 10 cwt. per acre., or about 1 ½ million tons. Accordingly the whole hay crop, not including pastures, amounts to upwards of 5 million tons, worth about £14 000 000, or a third of the value of the total produce of the country.

Sweden possesses a great extent of pastures, but there are no available data as to their area and yield.

The area devoted to the cultivation of plants other than grain, root and forage crops, amounted, in 1911 to only 4038 acres, of which 3783 were under textiles.

The land in Sweden devoted to horticulture is given for the same year at 112 978 acres, or about 1.25 per cent. of the cultivated area. Fruit growing is the principal branch and is carried on intensively in some localities. The growing of flowers under glass has also considerably developed and vegetables are grown all over the country both for private consumption and for sale. Schools for gardeners exist at Alnarp in Schonen, Adelsnäs in Östergötland, Experimentalfältet near Stockholm and Härnosänd in Norrland. Special schools of gardening for women are those at Exper-

näs in Närke and Torshäll in Dalarne. Cooperation in horticulture is in a flourishing condition.

Animal husbandry (1) has been from time immemorial the chief branch of agriculture in Sweden. According to official statistics the live stock in 1911 consisted of the following :

Horses under the age of 3 years	Horses over the age of 3 years	Steers	Bulls	Cows	Cattle under 2 years	Sheeps	Goats	Pigs	Reindeer
493 322	95 163	144 277	52 467	1837 038	655 830	945 709	66 136	951 164	276 084

By the thirties of last century the importantion on a large scale of foreign, especially English, breeds of live stock had already begun and the State promoted breeding by the institution of central breeding farms for cattle and sheep ; these were, however, broken up about the end of the 19th century and the stock sold off. The proceeds were devoted to a "Fund for the improvement of Swedish cattle and sheep". Among the general measures adopted for the promotion of animal husbandry, prize giving is now the most important. There are prizes for horses, cattle, sheep and pigs. In 1911 the amount spent in prizes for cattle was £19 350 of which the State contributes £6 600.

At present the five following breeds of cattle are awarded prizes.

1) The *Fjäll* (North Swedish cattle) in Norrland and Dalarne ; the cows yield about 550 gallons of milk per annum with an average fat content of 3.8 per cent . ; their live-weight is about 770 lbs.

2) The *Swedish Red Poll* in Dalarne, Bohuslän and other districts ; their milk yield and live-weight are about the same as in the Fjäll.

3) The *Ayrshire* in Southern and Central Sweden ; the cows give about 770 gals. of milk containing an average of 3.6 per cent. of fat ; their live-weight is about 1000 lbs.

4) The *Red Spotted Swedish* in Central Sweden ; yearly milk yield about 880 gals. with 3.8 per cent. fat ; average live-weight 1 100 lbs.

5) The *Black Spotted Swedish Lowland* in Southern Sweden : milk yield 990 gals. with 3.3 per cent. fat ; live-weight about 1265 lbs.

In the year 1911, 58 020 animals were exhibited, 50 761 taking prizes. Besides the awarding of prizes the following measures have also largely contributed to the success of Swedish animal husbandry : the institution of herd books, the auctions of breeding cattle, the competitions for the formation of cattle-breeding centres, the record associations and the veterinary and educational services.

In the breeding of horses heavy draught horses occupy a prominent position. To this type belong the Dalbo horse in Dalsland and northern Bohuslän and the North Swedish horse. They are rather small but power-

(1) See also E. O. ARENANDER : "The recent development of Cattle Breeding in Sweden". — *B.* Oct. 1913, pp. 1502-1511. (*Ed.*).

ful, resistant and exceptionally thrifty animals. In order to give the Swedish horse more bulk and strength the following foreign strains of blood have been introduced, especially since the middle eighties of last century: Percherons, Pinzgaus, Clydesdales, Norwegians and Belgians. The first two have not had any notable influence on the native breeds. Clydesdales, which in Wästergöttland laid the foundation of the Levene horse, have had a certain importance, especially in the beet-growing districts; but they are giving place to Belgian Ardennes, which have been crossed with the native breed to produce a compact, powerful horse with lively action (1). In 1901 the studbook for Swedish Ardenne horses was founded; out of the hundred or so stallion and horse-breeding associations existing in the country about seventy aim at the production of an Ardenne type.

Of much less importance than the breeding of draught horses is the breeding of half blood horses, which are chiefly devoted to the production of army remounts. For these there are two stallion depots: Flyinge in Schonen and Strömsholm in Västmanland, with about 230 stallions. Of these about 20 are English Thoroughbreds, the rest Hanoverians and East Prussians. The breeding of Thoroughbreds in Sweden is insignificant. The breeding of poneys gains constantly in importance; the demand for poneys is met by importation from Iceland.

The breeding of pigs has gained much importance since the beginning of this century. The pig-breeding associations and stations are assisted by the State. Only English Large Whites and Swedish or Danish pigs are awarded prizes.

Sheep breeding is constantly losing ground. For the improvement of the sheep Cheviot rams, some imported from Scotland and some raised in Gottland, are used. In Southern and Central Sweden some English breeds, such as Oxford, Shropshire and Southdown, are kept. Merincs, which in the eighteenth century were very numerous, are now reduced to two or three hundred head in Sodermannland and Östergötland.

The breeding of reindeer is more important. In Sweden a distinction is made between the high mountain reindeer and the forest reindeer. The former spend the summer in the high mountain land and only the winter in the woods, while the latter live throughout the year in the woods. The value of the Swedish stock of reindeer may be estimated at about £250 000, while its yearly returns are upwards of £55 000.

Poultry breeding is highly developed in the south of Sweden. There is a considerable exportation of eggs and birds. The number of head of poultry is estimated at 4 250 000. The General Poultry Association founded in 1898 included, in 1910, 23 district associations with 6 601 members. There were also in the same year sixty egg-purchasing cooperative associations within the Län Malmöhus; these collected eggs from 160 receiving stations.

(1) See No. 754, *B.* Aug. 1914. (*Ed.*)

Bee-keeping has also made considerable progress during recent years. The number of hives in 1911 was at least 120 000 ; the yearly output of honey was estimated at 1 320 000 lbs. and that of wax at 23 760 lbs.

Table IV shows the foreign trade in animals and their products in recent years.

TABLE IV. — *Imports and exports of animals and their produce.*

	Imports		Exports			
	1908	1912	1908	1909	1910	1911
Horses . . . . head	1 953	2 224	3 991	2 514	4 264	6 803
Cattle . . . . . »	4 817	2 806	9 767	12 558	33 437	34 349
Sheep . . . . »	91	141	1 753	1 761	1 920	2 087
Pigs . . . . . »	6 528	5 358	10 126	61 007	53 885	199 404
Pork . . . . . lbs.	10 150 899	3 350 171	6 124 298	4 756 011	6 581 571	25 220 230
Other meat . . «	5 358 032	4 072 983	1 370 255	2 000 383	6 445 441	19 139 989
Cheese . . . . »	804 047	1 276 464	4 611	129 892	51 058	11 946
Butter . . . . »	275 051	272 547	346 784	48 274 065	47 849 903	46 720 788
Margarine . . »	6 017	325 224	1 015 879	215 983	202 200	48 710
Lard . . . . . »	4 874 252	1 911 945	109 571	22 222	58 089	32 769
Tallow . . . . »	13 653 977	6 756 774	1 772 593	1 110 809	1 989 123	1 331 770
Hides, uworked »	16 975 185	26 342 622	14 885 506	19 862 174	22 164 857	25 156 483
» worked . »	1 518 783	2 182 275	426 208	118 250	147 213	271 053
Bones and bone meal . . . . »	19 675 379	14 146 612	67 021	52 811	358 701	2 339 557
Wool . . . . . »	12 275 047	145 721	71 093	208 580	140 424	136 004
Honey . . . . »	151 954	41 111	1 373	163	684	315
Wax . . . . »	43 858	68 919	11 669	6 574	7 984	2 548
Eggs . . . . . No.	55 876 176	54 915 380	38 837 492	37 358 12	41 516 566	44 759 409

Dairying in Sweden, the history of which can be followed back for seven centuries, has developed very considerably since the milk separator was invented in 1878. In 1910 there were 1382 dairies in the country ; of these 542 were cooperative dairies, 457 collecting dairies, 276 estate dairies and 107 estate collecting dairies. Cooperation is most widely diffused in the southern and northern parts of the country, while in Central Sweden the estate and collecting dairies prevail. In 1911 the total amount of milk delivered at the dairies was 252 828 394 gals., of which 30 133 330 gals. were sold as whole milk ; the rest, upwards of 220 000 000 gals., was used in the manufacture of cheese and butter. The dairies producing only butter numbered 845, while 327 produced only cheese, and 208 both

butter and cheese. The amount of butter produced is constantly increasing; it was 57 450 840 lbs. in 1900, 61 598 700 lbs. in 1905 and 72 464 577 lbs. in 1910. The production is most intensive in Schonen and Halland, where in 1910 about half of all the butter produced in the country was made. Of the butter exported, 75.01 per cent. goes to England, 20.74 per cent. to Denmark and only 3.92 per cent. to Germany and 0.33 per cent. to other countries. The preparation of cheese has made slow but steady progress during the last twenty years; the increase is observed only in fat cheeses, the production of the other cheeses being on the decline.

Further assistance to dairying in Sweden is offered by the labours of dairy instructors and advisers, by the schools of dairying, by the dairy stations, exhibitions and the organization of the examinations of butter (the butter that has been examined being distinguished by a special mark).

The Royal Agricultural Department, under the Ministry of Agriculture which was instituted in 1900, is at the head of the State agricultural advisers, of the peat and fishery inspectors and of the 22 agricultural engineers; with the 26 Chambers of Agriculture at present existing, it takes all the public measures calculated to promote agriculture or proposes them to the Ministry.

Sweden possesses at present 15 farming schools, 33 schools of agriculture in which practical and theoretical courses lasting at least 20 weeks are held, two upper housekeeping schools in which women teachers of housekeeping are trained, two agricultural institutes for higher agricultural education (Alnarp and Ultuna), three schools of farriery and one veterinary college (Stockholm).

Further chapters treat of agricultural credit, of the control and experiment services (17 chemical control stations, one State central institution for agricultural experimentation and several other experiment stations connected with the agricultural institutions or founded by associations and chambers of agriculture, 17 seed control stations), of the question of seeds (Society for the Improvement of Agricultural Plants, Swedish General Seed Company and Svalöf Institute (1)), the work of the Swedish Moor Cultivation Society and other agricultural associations, the measures for promoting agricultural book-keeping, the question of agricultural labour, and agricultural legislation in general and that of farm renting in particular.

Forestry is discussed in a section by itself, from which a few figures are here given to show the importance of forestry in Sweden. Of the whole area of the country, 52 per cent. is covered by forest; that is 969 acres per 100 inhabitants, while Russia has only 415 for the same number. The 52 million acres of forest represent a total value of about £85 756 000. Only one-third of the forests are property of the State or of public bodies,

(1) See NILSSON: "The Swedish Institute for the Improvement of Field Crops at Svalöf". — *B.* June 1913, pp. 834-843. (*Ed.*).

the rest being private property. In 1911, 1 329 million cub. ft. of wood were cut ; in 1913 the value of wood imported amounted to £1 049 000 against £16 595 000 exported.

RURAL HYGIENE

871 – **Control of Beri-Beri: Curative Action of Autolysed Yeast Against Avian Polyneuritis.** (1) — COOPER, EVELYN ASHLEY (Beit Memorial Research Fellow, Lister Institute) in *The Biochemical Journal*, Vol. VIII, No. 3, pp. 250-252. Cambridge, June 1914.

The autolysis of yeast was obtained by placing pressed brewers' yeast in a flask in a hot room (35° C.) for 36 hours, when the yeast was rapidly converted into a brown fluid. This was filtered and the residue washed with a little water. Pigeons affected with polyneuritis were readily cured by 3 cc. of this liquid.

Experiments were also made with air-dried yeast, which had been stored for six weeks ; to this some water was added and it was then allowed to autolyse at 35° C. for 48 hours ; the filtrate was found equally curative.

The writer summarizes the results obtained as follows:

1. By the autolysis of brewers' yeast a solution can be obtained which possesses as marked curative properties towards avian polyneuritis as the original yeast.

2. The solution retains its curative power for at last eight weeks and when given orally to birds in doses 10 times as great as the minimum curing dose has no toxic action.

3. An air-dried yeast retains its curative power after storage for two years in a dry tin, and still autolyses after storage for four months.

The writer concludes that the autolysis of brewers' yeast should afford a simple and inexpensive method of preparing a non-toxic solution suitable for the oral treatment of human beri-beri.

AGRICULTURAL EDUCATION

872 – **American Black Flies.** — NALLOCH, Y. R., in *U. S. Department of Agriculture, Bureau of Entomology, Technical Series*, No. 26, pp. 72 + 6 plates. Washington. April 6, 1914.

The *Simulidae* are of considerable economic importance as parasites of domestic animals and man. The writer gives a classification and scientific description of the American species in all phases of their life cycle, based on a study of the collections in the United States National Museum. He distinguishes 5 species of *Prosimulium*, one of *Parasimulium* and 29 of *Similium*. A bibliography of 26 works on the subject is appended.

873 – **Agricultural Schools in Panama.** — *Daily Consular and Trade Reports*, Year 17, No. 172, p. 476. Washington, July 24, 1914.

Two agricultural schools are to be established in Panama. One of the schools will be located near New Gorgona. The Government is also contemplating the establishment of an agricultural experiment station.

(1) See also No. 1130, *B.* Aug. 1912. (*Ed.*).

874 – **The Experiment Farm at Genale, Italian Somaliland.** — ONOR, R. (Agricultural Adviser at Genale) in *Giornale di Agricoltura della Domenica*, Year XXIV, No. 30. Piacenza, July 26, 1914.

The fundamental technical problem in the agriculture of Benadir is that of irrigation. When that is overcome one may say that, apart from questions of practical convenience, almost every tropical crop is possible. On the other hand the draught animals are liable to serious parasitic diseases, so that the questions of cultivation of the land and transport become an additional problem. Further, in addition to these and other technical problems of first-rate importance, is the question of the economic value of the various crops.

In view of these facts the Government decided on the formation of an experiment farm at Genale, to which the Governor added four farms to be allotted to four families of Italians with a view to facilitating a preliminary colonization experiment. In February 1912 the first huts were built, and the station is now assuming its normal aspect with brick buildings constructed locally.

The mechanical elevation of the water for irrigation, which has been provided for at Genale by centrifugal pumps worked by oil engines, the study of the possible utilization of the wind, and the application of motor power to agricultural work and transport, are all questions for investigation which will entail considerable funds. Further, the administrative side of the farm will render assistance by providing information of great practical value. The book-keeping, which during the initial period was, owing to the opportunity offered, concerned only with certain items of outlay, is now carried out like that of any private enterprise.

The progress of the scheme has not so far allowed well organized experiments to be conducted, especially as the largest share of attention had to be given to crops which seemed likely to be of the greatest economic importance in Benadir. Among the plants already studied and those under experiment are the following :

I. Starch-producing plants : *Manihot utilissima*, *Dioscorea Batatas*.

II. Cereals : oats, maize, millet, barley and Indian upland rice.

III. Rubber plants : *Manihot Glaziovii*, *M. dichotoma*, *Funtumia elastica*, *Parthenium argentatum*.

IV. Dye and tannin plants : *Bixa orellana*, acacias, *Carthamus tinctorius*.

V. Spices : *Coffea liberica*, *Zingiber officinale*.

VI. Textile plants : *Fourcroya gigantea*, *Agave Sisalana*, *Corchorus capsularis*, various cottons, *Eriodendron anfractuosum* (kapok), *Hibiscus Sabdariffa*.

VII. Oil crops : coconut, earthnut, sesame, castor-oil.

VIII. Sugar crops : sugarcane, Minnesota sorghum.

IX. Fruits : *Citrus* spp. (orange, lemon, tangerine, grape-fruit), *Anona* (*muricata*, *Cherimolia*), *Mangifera indica*, olive, guava, bananas, papaw, pineapple.

X. Narcotic plants : tobacco.

XI. Timber trees and various : *Inga dulcis, Poinciana regia, Terminalia Catappa,* tamarind, *Eucalyptus Lehmanni, E. citriodora, Cedula odorata, Cassia florida, Casuarina equisetifolia, C. tenuissima,* bamboos, *Parkinsonia,* mulberry.

XII. Vegetables: French beans, *Dolichos,* cowpea, soy bean, capsicum, egg-plants, onions, cabbage, chicory, beetroot, *Hibiscus esculentus,* cucumbers, etc.

XIII. Leguminous forage plants : lucerne, sulla, sainfoin.

AGRICULTURAL INSTITUTIONS

875 – **The Reorganization of the Experimental Garden at Hamma, near Algiers.** — *Bulletin de l'office du Gouvernment Général de l'Algérie,* Year 20, No. 12, pp. 194-195. Algiers, June 15, 1914.

Several years ago the experimental garden at Hamma, which had been leased to a financial company in 1883, was taken over by the Algerian administration and reorganized on a rational system with a view to its better utilization. With this object two decrees were issued on June 5, 1914, the first cancelling the previous lease and approving the necessary equipment, the second defining the reorganization of the garden.

According to article 1 of the second decree, the experimental garden at Hamma is to serve the purpose of a nursery for the production and distribution of native crops and as a garden for scientific studies and the acclimatization of exotic plants.

The staff of the garden consists of administrator, head gardener, and clerk. The governing body consists of a permanent technical commission, comprising the following :

The Director of the Botanical Department.
The Professor of Botany.
The Director of the Pasteur Institute.
The Chief of the Forestry Research Station.
The Chief of the Agricultural Department of Algiers.
The Delegate of the Algerian Horticultural Society.

The garden collaborates with the Departments of Phytopathology, Forestry and Entomolgy, the Faculties of the University of Algiers, and, on advice from the technical commission, all other public services which require it. A museum of natural history for North Africa, the necessary laboratories and a small zoological park may be added, and a department of horticultural instruction will be organized for the education of working gardeners and grafters.

CROPS AND CULTIVATION.

SOIL PHYSICS, CHEMISTRY AND MICROBIOLOGY

876 – **A New Method of Determining the Density and Porosity of Soil and Rocks.** — Truka, Rudolf (Tábor, Bohemia) in *Internationale Mitteilungen für Bodenkunde,* Vol. IV, Part 4-5, pp. 363-387. Berlin, 1914.

The writer has devised a new method for the determination of the specific gravity of soils and rocks, based on the researches of Dr. Slavik. Its novelty consists in detaching a lump of earth from the interior of a lar-

er block without subjecting it to pressure or in any way altering its natural tate. The small lump is dried at 100° to 103° C., then plunged in liquid araffin at a temperature of 40 to 50° C., so that it becomes covered with very thin layer of paraffin. The volume of the sample is determined by isplacement of water in an apparatus specially designed by the writer, who escribes it in great detail.

The method is applicable to all types of adhesive soils and the writer continuing his studies with a view to devising a method suitable for andy soils. An examination of the results obtained by this and other ıethods has led the writer to the following conclusions :

A. *Specific gravity.* — 1) If the density of a soil is to be used for etermining its physical properties, a more exact method is required.

2) Those methods in which a given volume of soil is obtained by lling a standard measure, or by sedimentation in water, should be bandoned, since they do not take into account the stratification of ıe soil.

3) Methods involving the sampling of the soil by means of cylinders tubes should also be abandoned, since the experimental error is too reat.

4) The only method that can be recommended is one which consists taking lumps of earth showing the natural stratification unchanged, ıereby reducing the error to a minimum.

B. *Porosity.* — 1) For the porosity to be an exact indicator of the rcperties of the soil, it must take into account the natural stratification the land.

2) Any disturbance of the natural lie of the soil in sampling is inadmis-ble, as it will lead to changes in the porosity.

3) The determination of the porosity by means of a lump of soil showing ıe natural stratification is the only method which gives results agreeing ith practical experience.

4) Porosity cannot be considered alone in determining the value of a ven soil ; other properties must be taken into account.

7 – **A New Method for the Determination of Soil Acidity.** — Truog, E. (Wisconsin, Experiment Station) in *Science*, Vol. XL, No. 1024, pp. 246-248. Garrison, N. Y. August 14, 1914.

Acid soils boiled with zinc sulphide and water liberate sulphuretted ydrogen, traces of which can be easily detected with lead acetate paper. ı this besis the following method of determining soil acidity was evolved : gms. of soil are placed in a 300 cc. Erlenmeyer flask with 1 gm. of calcium loride, 0.1 gm. of zinc sulphide and 100 cc. of water.; the mixture is oroughly shaken and heated over a flame ; after the contents of the flask ve boiled one minute, a strip of moistened lead acetate paper is placed er the month of the flask and the boiling continued two minutes more, ıen the paper is removed. If the soil be acid the paper will be darkened the under side, the shade obtained varying with the degree of acidity ›m almost white to black, and the percentage acidity may be estimated means of a standard colour scale.

This test is more delicate than the litmus test, is extremely simple t carry out and has proved very reliable ; in no case have alkaline soils give a positive reaction, even when they had undergone previous anaerobi fermentation. Experiments are now in progress to make the method mor accurately quantitative by titrating the liberated hydrogen sulphide wit iodine solution.

PERMANENT IMPROVEMENTS. DRAINAGE AND IRRIGATION

878 – **The Ombrone Diversion for the Reclamation of the Plain of Grosseto Italy.** — Luiggi, Luigi, in *Giornale del Genio Civile*, Year LII, pp. 254-260. Rome May 31, 1914.

The Ombrone diversion in the province of Grosseto, Italy, is one of th most important hydraulic works now in course of construction.

It will be capable of conveying 21 200 cubic feet of water per second and in case of need even 24 700 cu. ft., whilst the Cavour Canal (so far th largest in Italy) conveys only 3885 cu. ft., the Ganges Canal 6710 cu. ft feet, and the Euphrates diversion (1) (hitherto the largest in the world 14 125 cu. ft.

The object of the Ombrone diversion is not irrigation, as in the above mentioned schemes, but the utilization of the silt carried down by th water for reclaiming, by means of warping, the swamps which the protru sion of the river mouth has produced in the neighbourhood of Grosseto

The flood water sometimes contains for about 24 hours as much a 10 per cent. of silt, and on the average there are six good floods every year

In order to utilize this material to the best adavantage, it is necessary to waste no time in securing the greatest quantity of water when it ha its maximum load of silt and to fill all the depressions as speedily as pos sible ; hence the necessity of a large intake with rapidly acting sluices.

The works consist in : 1) a submergible weir across the bed of the rive at the head of the canal ; 2) a head regulator or barrage ; 3) a channe between the weir and the regulator ; 4) the main canal for the flood wa ter ; 5) distributing secondary channels ; 6) channels for draining off th clear water after the silt has been deposited ; 7) accessory works for th power plant to work the sluices and for the electric lighting of Grosseto storehouses, bridges, etc.

The submergible weir is 502 feet long. It is a mass of concrete face with ashlar. The vertical section of its surface is a sinusoid curve whic prevents the formation of vortices. It was built in 1879 and has successfull withstood the heaviest floods.

The regulator barrage has seven openings from 15 ft. 3 in. to 17 ft. 9 i wide and 20 ft. 7 in. high, closed by sluice gates worked by electric powe which can be completely raised or lowered, two at a time, in 8 minute The piers of the archways are 3 ft. 8 in. thick.

The main canal is about 180 feet wide at the bottom and is capab of conveying 21 200 cubic feet of water per second with a depth of wat of 17 ft. 4 in. and a velocity of 7 ft. 8 in. per second, or 24 700 cu. ft. wit a depth of 18ft. 4 in. and a velocity of 8 ft. 4 in. These high velociti

(1) See No. 414, *B.* May 1914. (*Ed.*).

are necessary firstly to keep the dimensions of the canal within reasonable limits and secondly to prevent any untimely deposit of silt.

Close to the regulator two buildings have been erected, one for two groups of 40 HP oil motors which drive the dynamos and a 20 HP motor for the workshops and electric light, etc., and the other as a storehouse, workshop and dwelling house for the workmen.

At the side of the canal between the weir and the regulator there is another building with a one-arch regulator for a power channel for the electric lighting of the city of Grosseto and a grain mill. This channel conveys 176 cu. ft. of water per second.

The main diversion or warping canal is about 10 ½ miles in length; for the first 2625 feet it is lined with masonry walls about 164 ft. apart. The rest of the canal is between embankments; it is 213 ft. wide at the water level and 178 ft. at the bottom, in which a small channel has been excavated to drain the canal when not in use, so as to prevent the breeding of mosquitoes. The canal is crossed by seven bridges and feeds the secondary distributing channels which convey the water to the various sections. Provision is also made for the drainage of the adjoining country.

It is calculated that in 24 hours 1236 million cubic feet of water can be collected to fill all the warping sections and that the passage of muddy water and discharge of clear water can be continued without interruption as long as the flood lasts.

The depth of the silt deposited by the floods is about 4 inches per year, but the swampy bottom, consisting of marine mud and peat, will subside under the weight of the silt; consequently the warping will be slow; it is, however, believed that the whole area of 12 350 acres will be completely reclaimed in about 30 years and will then provide excellent soil for farming purposes. Meanwhile the outside belt of the depression is already reclaimed and public health at Grosseto has already much improved.

The cost of the intake and canal is estimated at £ 160 000 and that of the whole work, including the drainage channels and regularization of rivers and a navigable canal, at £ 800 000.

79 – **The Composition and Value of Bat Guano.** — MILLER, C. F. (Bureau of Soils, U. S. Department of Agriculture, Washington) in *The Journal of Industrial and Engineering Chemistry*, Vol. 6, No. 8, pp. 664-665. Easton, Pa., August 1914. MANURES AND MANURING

The following results of a series of analyses of bat guano were obtained by the Bureau of Soils.

The notable variations of composition are due to: *a*) the presence of foreign matter, such as rock fragments, etc. (the Porto Rico samples were very rich in lime); *b*) the loss of useful constituents by washing out and by the decomposition and volatilization of nitrogen compounds.

The sample from Haiti is a pure bat guano of recent formation and practically undecomposed. It is calculated that this deposit contains about 000 tons valued at about £ 5 600, taking the price per ton as £ 8 approx., based on its chemical composition. This deposit exceeds the average in both quantity and quality.

Analyses of Bat Guano (percentage of dry matter).

Locality	Nitrogen	Phosphoric acid	Potash	Volatile matter
Carlsbad, New Mexico	4.24	2.31	1.28	—
Guadeloupe Mts., N. M.	1.77	2.68	0.41	40.0
Torreon, N. M.	10.82	1.08	1.01	—
Oregon Co., Montana.	8.10	2.06	0.58	—
San-Juan, Porto-Rico	1.00	3.40	0.21	—
» »	0.50	2.40	0.29	—
El Fondo, S. Domingo, Haiti.	11.84	4.80	1.61	—

No precise data relating to the area of bat guano deposits in the United States exist, but they are known to be very extensive.

880 – **The Solubility of the Various Constituents of Basic Slag.** — SIROT, MAURICE and JORET, GEORGES (Yonne Agricultural Station) in *Journal d'Agriculture Pratique* Year 78, Vol. I, No. 25, p. 78. Paris, June 18, 1914.

Besides phosphoric acid, basic slag contains other elements (magnesia, sulphur, manganese, iron, etc.), whose usefulness as soluble chemical manures has been recognized for some years.

The writers have endeavoured to find out to what extent these elements are soluble, both by Wagner's reagent and by solution in various organic acids of such concentration that the acidity of the solution is equal to that of 2 per cent. citric acid (Wagner's reagent). The method was the same as that employed in determining the citric-soluble phosphoric acid.

From their very numerous analyses, the writers have found that all the elements studied (silica, phosphoric acid, lime, magnesia, sulphur, iron and manganese) exist in a form soluble in various weak acids; the degree of solubility varies according to the fineness of the slag or to the actual solubility of the salts formed (citrates, malates, lactates, etc.).

The degree of solubility of the different elements varies as follows:

	per cent
phosphoric acid	24 to 87.2
lime	48.4 to 89.4
magnesia	3.1 to 67.6
iron	10.8 to 41.4
manganese	7.7 to 39.7

Citric and malic acids have the greatest power of solution, and lactic, acetic, tartaric and oxalic acids follow in order.

In the slags studied there are few insoluble silicates. The silica is very soluble in weak acids, citric, lactic and malic dissolving about 90 per

cent. of the total. It appears that the solubility of this element varies with that of the phosphoric acid, as would be expected if these two elements are in a state of combination as silicophosphate, as many writers affirm. The solubility of iron and manganese also appears to vary in the same proportions.

In conclusion, basic slag can be considered not only as a phosphatic manure but also as a compound manure.

881 – **Measures for Meeting the Shortage of Potash Manures in Great Britain.** — *Leaflet of the Board of Agriculture and Fisheries.* London, August 1914.

The Board of Agriculture and Fisheries desire to draw the attention of farmers and gardeners to the need for seeking new sources of potash manures, since the existing stock is very small and no further importation is possible for the present.

The chief natural sources of potash immediately available are: 1) seaweed, and 2) weeds, prunings, hedge-clippings, brushwood, leaves and vegetable refuse generally.

Seaweed is already extensively used as a manure on the coasts, and all who have access to this source of supply should collect it in quantity. Broad weed (*Laminaria*) may be used direct as a manure; grassy weed and tangle (*Fucus*, etc.) should be dried and burnt wherever possible. A ton of fresh seaweed should yield 20 to 30 lbs. of potash, or sufficient to manure from a quarter to half an acre of potatoes.

Inland farmers and gardeners may obtain potash by burning all kinds of vegetable refuse not suitable for direct application to the soil. The percentage of potash in vegetation varies very widely; among ordinary weeds for example, thistles might yield 5 per cent. and nettles 2.5 per cent. of their weight as potash; timber contains very little potash, cordwood a considerable quantity, and brushwood still more; ordinary wood ashes might contain from 5 per cent. to 10 per cent. according to their source. Ashes from the burning of weeds, prunings, hedge-clippings, etc., may contain from 10 to 15 per cent. of potash, i. e., corresponding to an equal weight of kainit, which last spring sold at about £ 2 10*s* per ton.

It is absolutely essential, in the absence of full supplies of farmyard manure, that potash should be supplied to such crops as potatoes and (on light soils) turnips, and that it should be available in gardens for potatoes, carrots, parsnips, onions and many other crops.

In many districts farmers might advantageously employ unemployed labourers in the collection and burning of all vegetable refuse. The ashes should be stored in a dry place and applied in the following spring.

882 – **Coloration of the Seed-Coat of Cowpeas.** — MANN, ALBERT (Plant Morphologist, Bureau of Plant Industry, U. S. Dept. of Agriculture) in *Journal of Agricultural Research*, Vol. II, No. 1, pp. 33-56 + 2 figs. Washington, April 15, 1914.

This study was undertaken to determine the possible relationship between the arrangement of the various layers of pigment and the heredity of colour in the seed coat, and to verify the supposition that colours optically alike are, in some cases, different in the constitution of the pigment

and place of deposit. The subject is dealt with under the following heads : Methods of Preparation, Morphology of the Seed Coat, Pigmentation of the Basal Colour Layer, Pigmentation of the Palisade Layer, Seeds Destitute of Pigmentation, Classification of Colour Factors in Cowpeas, Classification based on Distribution and Kinds of Pigments (1. Cowpeas having no pigment in the palisade layer ; 2. cowpeas having only anthocyanin in the palisade layer ; 3. cowpeas having only a melanin-like pigment in the palisade layer ; 4. cowpeas having both a melanin-like pigment and anthocyanin in the palisade layer).

The writer summarises the results as follows. The greatly diversified colour schemes of the different varieties of cowpeas may therefore be reduced to two factors : 1) an extremely uniform basal colour, ranging from very pale yellow to deep copper red, but found to be in all cases due to a melanin-like pigment deposited in the basal colour layer, the differences in tint being unquestionably caused by differences in quantity rather than in character of the pigment present ; and 2) a superimposition upon this basal colour of variously arranged pigment areas in the palisade layer, the outer layer of the seed coat, the pigments here being of only two kinds, first, a melanin-like pigment very generally identical in colour and behaviour to that found in the basal layer, and, second, an anthocyanin pigment, either associated with this or found in separate cells.

This anthocyanin pigment may be of a red or blue colour according as the reaction is acid or alkaline, and these two colours may be found in the same cells or in separate cells. Finally, according as only one or more than one or all of these pigments are present in the palisade layer, or according as they are uniformly distributed throughout its cells or are variously localised in large or small areas of its cells, we get the remarkably diversified blotching, streaking, speckling, marbling or monochrome colorations which characterise the different varieties of cowpeas.

In cases where the seed coat is white or cream coloured, or has a certain white area, or even where there is merely a slight speckling, the palisade cells show great distortion of outline and unevenness in the cell cavity. Again, in most parti-coloured cowpeas of strongly contrasted tints, the strongly coloured areas have perfectly regular, symmetrical palisade cells, while the lighter areas are more or less strongly contorted in form and irregular in the cell cavity. In other words there is a decided correlation between the morphology of the palisade cells and the suppression of the pigments in these cells.

85 - **Palms Indigenous to Cuba.** — BECCARI, ODOARDO, in *Pomona College Journal of Economic Botany*, Vol. II, No. 2, pp. 253-276, and No. 4, pp. 351-377 ; Vol. III, No. 1, pp. 391-417. Claremont, California, March and December 1912 ; February 1913.

List and botanical description, accompanied by figures, of palms indigenous to Cuba and neighbouring islands. Twenty-five species are described, of which two belong to the family *Cocoineae*, six to *Areceae*, and the majority of the rest to *Corypheae*. The writer concludes with an account of the mode of growth of the trunk of palms.

884 – **The Influence of Pressure on the Structure of Roots.** — MOLLIARD, MARIN, in *Revue Générale de Botanique*, Vol. 25 (bis), pp. 529-538. Paris, 1914.

The roots of plants growing in soils on schist formation often penetrate between two strata and become subjected to considerable pressure, which results in malformation. The writer summarises the anatomical characters of such roots as follows :

1). The cells are narrower.

2). The living cells are only slightly deformed, whilst the older tissues, such as the wood vessels, are flattened out.

3). Cell division ceases beyond a certain pressure, but without the life of the cells being destroyed.

4). The xylem and phloem elements grow chiefly in a direction parallel to the plane of the pressure.

5). Differentiation of secreting canals may cease.

6). The fibrous tissues are largely or entirely suppressed.

7). The two extremities of the compressed portion of the root become hypertrophied.

These observations were made on material of *Carlina corymbosa*, *Oenanthe Crocata*, *Plantago maritima* and *Hedera Helix*.

885 – **The Aroma of Hops : Studies of the Essential Oil and its relation to Geographic Distribution of Hops.** – RABAK, FRANK (Chemical Biologist, Drug-Plant and Poisonous Plant Investigations, Bureau of Plant Industry, U. S. Department of Agriculture), in *Journal of Agricultural Research*, Vol. II, No. 2, pp. 115-159, + 14 figs. Washington, D. C., May 1914.

The writer has made determinations of the following properties : specific gravity, optical rotation, refractive index, solubility in pure or dilute alcohol, boiling point, ester value, acidity, saponification index. Comparisons have been made of hops from the United States (California, Oregon, Washington, New York) with hops from Bohemia (Saaz) from authenticated sources during four consecutive years.

The volatile oil was prepared by distillation in a current of vapour. The average yield of essential oil varies considerably for a given locality from one year to another. The specific gravity of the essential oil from different Californian hops was almost constant during the same season and varied very little from one year to another . A similar observation was made with regard to the refractive index. The averages of numerous determinations obtained during several years are given in the following table. The data relating to Californian hops are from samples from five different sources.

The writer concludes from his results that the volatile oil of hops consists chiefly of : 1) myrcene ; 2) esters consisting of compounds of heptoic (œnanthylic), octoic (or caprylic), nonoic (or pelargonic) acids in combination with myrcenol (alcohol) ; 3) humulene ; 4) traces of free acid ; 5) formaldehyde. The various essential oils examined contained different proportions of ester, myrcene and humulene. Although not much importance is attached to the two latter constituents, the variations of strength of ester are very significant in relation to the aroma.

The chief chemical and physical properties of the essential oil of hops.

Origin	Essential oil, per cent.	Specific gravity	Refractive Index at 20° C.	Volume of ess. oil. soluble in 3 vols. of alcohol at 94° C. (1909)	Index of acidity	Ester value	Index of Saponification
California .	0.324	0.8326	1.4775	0.8	1.41	45.6	47.0
Oregon....	0.290	0.8385	1.4745	1.0	2.70	58.8	61.5
New York.	0.192	0.8554	1.4753	0.8	3.25	50.9	54.2
Washington	0.370	0.8482	1.4748	0.9	1.25	52.8	54.0
Imported .	3.310	0.8433	1.4862	0.75	2.02	23.5	25.5

Important differences in the constitution of the essential oils occur not only in hops of the same season and from different districts, but also from the same districts during several seasons. These differences appear very prominently in the curves of the chemical and physical properties. The curves of fractional distillation representing a partial quantitative separation of the principal constituents show very clearly the relation between the hops of a particular district during the different seasons. The curves of optical rotation also show this relation very clearly. Generally, the physical properties (fractionation, specific gravity, and optical rotation) show the existence of strong resemblances between the essential oils of the same type and strong differences between oils of different type.

Since the esters are the most important constituents affecting the aroma of hops, the various hops have been compared by means of the ester values of their essential oils after distillation. The curves of the strength of ester of different essential oils and their fractions show at once the different geographical distributions. All hops from countries other than North America were always difficient in esters.

The essential oils of hops from California are very similar from one year to another with regard to their physical and chemical properties. The hops from the various parts of California are very analogous and give parallel curves each year. The essential oils of hops from Oregon and Washington are very analogous, but show slight differences from those of California. The hops from New York State resemble foreign varieties with regard to essential oil, but are richer in esters. Arranged in the order of increasing strength in esters they are as follows: imported hops, Californian, Washington, New York, Oregon, the last three being almost alike.

It has not been possible to establish any relation between the ester value of the essential oil and the quality of the hops, though this value shows a distinct relation to the place of origin in every case. A bibliography of twenty-seven works is appended.

886 – **Fenugreek Seeds.** — WUNSCHERDORFF (Chief of works of the Faculty of Medicine and Pharmacy at Algiers), in *Journal de Pharmacie et de Chimie*, Year 106, 7th Series, Vol. X, No. 4, pp. 152-155. Paris, August 16, 1914.

Fenugreek seeds are exceptionally rich in nitrogen and phosphorus, the former in the form of albuminoids, the latter in the form of phytin, nucleo-albumin, and especially lecithin (1.5 to 1.7 %) which is present in greater quantity than in any other seed. The flour obtained from the decorticated seeds contains 5.81 % of nitrogen, corresponding to 36.3 % of albuminoid matter, 1.042 % of phosphoric acid, of which 0.135 % is in the form of lecithin, 0.758 % as phytin, and 0.149 % as nucleo-albumin. These seeds are therefore of high nutritive value. They were used by the ancients in recuperating the constitution and are now used by the natives of North Africa as a protection against disease, an extract being used as a febrifuge. The writer confirms their food value but doubts their medicinal value. The bitter flavour and disagreeable odour after eating are much against their use. The writer has found that this disagreeable odour is due to a diastatic action taking place during the final stage of ripening of the grain, and that it disappears on germination. Treatment with boiling alcohol and rapid drying at low temperatures destroys the odour and enables them to be preserved indefinitely in air-tight tins.

887 – **The Assimilation of Atmospheric Nitrogen by Plants.** — KÖVESSI, FRANÇOIS, in *Revue générale de Botanique*, Vol. 25 *bis*. (Researches in Vegetable Biology : dedicated to GASTON BONNIER by his pupils and friends on the occasion of the 25th anniversary of the foundation of the Laboratory of Plant Biology at Fontainebleau), pp. 405-415. Paris, 1914.

The writer confirms the previous conclusions concerning the utilization of the free nitrogen of the air by plants (1). Plants were grown under the two following conditions : 1) in an atmosphere without nitrogen (oxygenated) ; 2) in the open air. The two series gave the same reactions, showing the presence of protein in the hairs, particularly in the specialized hairs studied by JAMIESON, and by ZEMPLÉN and ROTH, who attribute to them the power of absorbing and fixing nitrogen from the air.

Various protein reactions were applied, from the results of which the writer draws the following conclusion : The presence of protein in the hairs of plants grown in a nitrogen-free atmosphere shows that it is due to cell growth and normal nutrition, and not to a direct assimilation of atmospheric nitrogen. Thus the theory of Jamieson, Zemplén and Roth, that the protein in the hairs is formed only from atmospheric nitrogen, is untenable.

888 – **Physiological Researches on the Germination of the Pollen of *Vitis vinifera*.** — GARINO CANINA, E., in *Le Stazioni Sperimentali Agrarie Italiane*, Vol. XLVII, Part 7, pp. 480-492. Modena, 1914.

From a study on the germination of vine pollen, the following conclusions have been drawn :

1) The pollen grains of the vine require an acid medium for develop-

(1) See No. 1113, *B.* April 1911. (*Ed.*).

ment, in accordance with the strongly acid reaction of the sap of this plant.

2) The most suitable medium for laboratory experiments is one containing 15 per cent. saccharose, 2 per cent. gelatin, and tartaric acid in the proportion 1 : 4000.

3) Prolonged rainy weather, by diluting the stigmatic secretion, may cause the pollen grains and tubes to burst, as is the case when germination is effected artificially in distilled water.

4) Temperatures outside the limits of 14° C. and 35° C. during the flowering period produce sterility, owing to the absence of germination below 14° C. and to the abnormal development of the pollen tube above 35° C.

5) Many of the fungicides used on vines are injurious to the pollen grains.

6). The grower should have no difficulty in choosing between a possible danger of sterility and the certainty of infection by oidium or mildew.

PLANTS BREEDING

889 – **Thirteen Years of Wheat Selection.** — HUTCHESON, T. B. (Associate Agronomist, University of Minnesota), in *The American Naturalist*, Vol. XLVIII, No. 572, pp. 459-466 + 3 tables. Lancaster, Pa., August 1914.

In 1901 the Minnesota Agricultural Experiment Station planted a number of varieties of wheat from the *polonicum*, *spelta*, *turgidum*, *durum*, and *vulgare* types. Six of these varieties (one each of *turgidum*, *vulgare*, *spelta* and *durum*, and two of *polonicum*) have been grown continuously and selected by the centgener method. This method consists in planting one hundred selected kernels from each plant, at equal depths and at equal distances apart in separate plots. Careful notes are taken of the plants of each centgener, and at harvest five or more of the highest yielding plants are selected, from which the seeds for planting the next year are taken. From these five best plants, from five to ten of the best heads are selected and thrashed together. One hundred of the largest and plumpest kernels are selected and planted in the centgener test next year. This operation is continued from year to year.

In 1908, an experiment was planned with the object of developing a strain of wheat which would have a minimum amount of culm exposed between the base of the spike and the upper leaf sheath, *i. e.* a short-necked variety of wheat. The ultimate purpose of this was to reduce the area of the stem exposed to the black stem rust, which does not attack that portion of the stem enclosed in the leaf-sheath. For this work individual plants were selected which had short necks and the seeds from these were planted in separate centgeners. A continuous selection of short-necked plants was made during the succeeding years.

Each centgener was started from a single head in 1901, and since wheat is normally self-fertilised, these heads have bred true to type ever since. Thirteen years of selection in one pure line is the longest period of continuous selection yet reported for a self-fertilised plant, thus making these data of considerable importance.

Tables are given showing the results of selection for increased yield (1901-1913), for increased height (1901-1913) and for short neck (1909-1913). From the data presented in these tables it is evident that there has been no permanent gain for these thirteen years of selection, either in yield per plant, height of plant, or shortening of neck-length. Only the expected seasonal variations occur, which were the same, with regard to production, as in the continuous open field experiments without selection.

A comparison of the yield of each variety for the first five years of the test with that of the last five years is shown in the accompanying table, which shows that there is no significant difference in yield for these two periods.

Variety.	First 5-year period.		Last 5-year period.	
	Height. in.	Yield. gms.	Height. in.	Yield. gms.
Hedgerow (*turgidum*)	41.6	2.67	38.4	2.34
Russian (*vulgare*)	38.0	1.99	35.4	2.18
Spelt (*spelta*)	40.0	2.51	39.2	2.40
Kamouka (*durum*)	36.4	2.01	35.8	1.97
Polish I (*polonicum*)	39.9	1.54	37.4	1.61
Polish II (»)	33.4	1.62	33.4	1.31
Average . . .	38.2	2.06	36.5	1.97

From the practical breeder's standpoint permanent improvement in pure lines of small grain, if possible, is certainly not rapid or apt to be very marked. It is probable that much more rapid progress could be made by segregating pure lines from mixed populations and combining the desirable characters of these lines by hybridisation.

890 – **Note on the Selection of Maize in Cambodia.** — De Flacourt, Martin (Chief of Agricultural and Commercial Service in Cambodia), in *Bulletin économique de l'Indo-Chine*, Year 17, No. 107, pp. 215-218. Hanoi Haiphong, March-April, 1914.

Maize is extensively grown in Cambodia chiefly as food for the inhabitants, and it generally precedes rice in the rotation. There are two chief varieties : one with orange yellow grains, the other with milky white grains, the vegetative periods being 90 and 105 days respectively.

The writer proposes selecting local varieties with a view to improving their earliness. These two varieties show considerable variation as regards coloration of the grains and number of secondary tillers, and sometimes show pale green or white striations on the stem and leaves. These variations cannot be explained by hybridisation alone, but would seem to indicate a tendency to mutation amongst some individual plants.

In these experiments the writer found that the variation was increased by exposing the ripe ears freed from the sheath for several days, thus

causing a cracking of the grains similar to that produced by the mechanical process employed by BLARINGHEM. The present pedigrees are too short to enable conclusions to be drawn.

It was also found that the secondary shoots, in many cases, flower at the same time as the main shoot, and though some 20 to 23 days younger than the latter, they ripen their grains at the same time, thus having a shorter vegetative period. The inflorescences of the secondary shoots are of three different forms: 1) they are exclusively unisexual, 2) the female inflorescence is normal in type but surrounded at its base by small ears, 3) the terminal panicle carries both male and female flowers. Seed is selected only from the best grains produced by the normal inflorescences of the secondary shoots, and it is found that the earliness of maturity of these seeds is inherited by the descendants.

Plants were also raised from seeds from the abnormal inflorescences of the last two types; they produced perfectly normal male and female inflorescences with the same degree of earliness of maturity.

AGRICULTURAL SEEDS

891 – **Innovation in the Danish Trade in Seeds of Root Crops.** — *From a Communication by* H. HELWEG, *Director of Experiments at Copenhagen.*

In Denmark the State has for a number of years carried out trials of root crops, for which any Danish seed breeder can enter his strains of seed. According to the results the strains are divided into three classes. The names of the breeders of the first class seeds are published. Owing to the great demand for seeds on the part of the trade, prices rise very high and this stimulates the breeders to further exertions. Thus 10 *s* a pound is now paid for pedigree mangold seeds and 20 *s* a pound for turnip and swede seeds.

This cooperation of State, breeder and seedsman has already led to an increase in the yield of Danish root crops.

Of late years the practice has been introduced of selling seeds of root crops with a guarantee as to their quality, as has long been done for grass seeds.

For both root-crop seeds and grass seeds the value of the crop depends upon the genuineness of the seed, but with this difference, that the genuineness of grass seed can be recognized by examination, while the quality and strain of root-crop seeds cannot; the analysis of the latter carried out by the seed control stations has therefore little value, whereas in the case of grass seeds it is so useful that it has become customary to base the price upon it. It is further to be noted that the analysis of a parcel of grass seeds can be controlled by another examination in spring, while the quality of the root-crop seeds can only be checked in the autumn by an expert examination of the roots in the field in which the seed was sown in the spring.

Complaints as to the quality of the seeds sown in spring are allowed up to the 15th of October of the same year.

In the spring of 1912 the guarantee for genuineness of Danish root-crop seeds was introduced into the home trade and in 1913 into the foreign trade. Not all the wholesale seedsmen have adopted the guarantee system

in their transactions, but they must henceforward mention it expressly on their business papers, etc.

For the settlement of possible disputes concerning the guarantee, an official (of the Weights and Measures Bureau) takes an average sample from the seeds sold under such guarantee and sends it to the State Commissioner for root crops, who has all the samples sent in sown in a control field recognized by the State. Complaints from abroad are to be brought before the Maritime and Commercial Tribunal of Copenhagen, which appoints two or three experts to examine the roots produced in the above field by the seed in question, and if the seeds delivered do not correspond to their description the amount of compensation due is determined on the result of the test made in the experiment field.

892 – **The Longevity of Some Common Seeds.** — EASTHAM, ALFRED (Chief Seed Analyst, Department of Agriculture of Canada, Seed Branch) in *The Agricultural Gazette of Canada*, Vol. I, No. 7, pp. 544-546. Ottawa, July 1914.

Researches on the longevity of seeds were begun in 1903 and will be continued until the vitality of the seeds has been entirely lost. Seeds of

	Germinating capacity after:			
	1 yr.	5 yrs.	7 yrs.	10 yrs.
Timothy:				
Average of 12 samples harvested in 1902	97	90	83	56
Average of 12 samples harvested in 1903	93	90	85	52
Red clover:				
Average of 12 samples harvested in 1902	97	76	61	44
Average of 12 samples harvested in 1903	96	75	68	43
Alsike clover:				
Average of 12 samples harvested in 1902	93	79	66	45
Average of 12 samples harvested in 1903	93	81	72	45
			after 10 yrs.	after 13 yrs.
Oats:				
Average of 53 samples harvested in 1900 (1)	94	95	93.5	91
Average of 64 samples harvested in 1901	98	97	96	—
Average of 63 samples harvested in 1902	95	97	97	—

(1) From the various provinces of Canada.

high germinative capacity were chosen and stored in sealed boxes in the Seed Branch Laboratory of the Department of Agriculture. The results are shown in the accompanying table.

CEREAL AND PULSE CROPS

893 – **The Influence of External Physical Agents on the Germination of Wheat.** — 1. LOYER, HENRI. – 2. RIVIÈRE, C. — *Bulletin de la Société Nationale d'Acclimatation de France*, Year 61, No. 14, pp. 447-456. Paris, July 15, 1914.

I. — The writer states that the influence of physical agents on germination requires a more precise investigation and that many problems remain to be solved in regard to aeration, moisture and temperature. For example : the limits of rarefaction and pressure between which germination is possible, the gradual reduction of germinative power, the maximum and minimum quantities of water favourable to germination, and the correlation of data relating to the duration of germination in relation to temperature. The writer points out that the temperature data obtained by the methods of RÉAUMUR, DE GASPARIN, DE CANDOLLE, TISSERAND are not concordant, since they show great differences for the same vegetative period of the same plant. He proposes a method of his own which appears to give better results.

The sum-totals of the daily means of the squares of the hourly temperatures always give the same result for the germinative period of the same plant. In the case of wheat, for example, the number always approximates to 1500, provided that the squares of temperatures above 20° C. are reckoned as 400 and that only the temperatures between 0° and 20° are included in the actual values.

The writer considers that these generalisations are common to all plants and intends to verify them in cases other than wheat.

II. — The following comments have been made by M. C. RIVIÈRE.

These experiments have the advantage of being carried out under precisely controlled conditions, the same plant being used throughout, since each variety requires certain variable meteorological conditions to complete its development. The results are interesting, but some indication, however approximate, should be given of the meteorological conditions affecting germination, such as soil temperature, illumination and humidity.

Rise of temperature, for example, does not always coincide with increased illumination, and the more rapid development of wheat in northern Europe near the arctic regions is due more to increased illumination, than to the temperature. Thus, the intensity of light during the night should be taken into account. Further, what method of computation can take into account all meteorological influences ?

There are also meteorological influences which are difficult to define and determine. Since our determinations of meteorological conditions are as yet only rudimentary compared with the complexity of the subject, all conclusions should be considered as arbitrary only. The method of M. LOYER will tend to narrow down the problem. It is possible to determine the number of calories necessary for the germination of wheat by experiments *in vitro* with temperatures controlled and automatically recorded, but the results thus obtained are so far removed

from natural conditions that they are useless to determine the actual meteorological conditions conducive to good or bad germination. This is the problem which still awaits solution.

894 – **Studies on the Pollination of Lucerne in its Relation to Seed Production.** — PIPER, C. V.; EVANS, MORGAN W.; MCKEE, ROLAND, and MORSE, W. J., in *Bulletin of the U. S. Department of Agriculture*, No. 75, pp. 32 + 1 fig. Washington, April 8, 1914.

In the regions of the United States where lucerne is grown for seed, the yield varies considerably from one season to another. Thus, in Milk Valley, Montana, in some seasons the yield has reached 10 to 12 bus. per acre, whilst in others it has been practically nil.

With a view to finding the cause of this difficulty the Department of Agriculture in 1906 undertook a series of experiments at several stations. The problem was found to be a most complex one, depending not only on the abundance of insects for pollination, but also on the climatic conditions. Under certain climatic conditions autogamous pollination is an uncertain factor from one season to another and among different individual plants. The factors or conditions favouring the production of seed vary during the season, as is seen from the occurrence of pods amongst the mature plants. On several occasions, especially during the first cut, it has been seen that artificial pollination by agitation of the stamens does not result in fructification.

The writers reviw the work of previous authorities on the structure and pollination of the flower of lucerne, showing conclusions at variance with each other. Only in some cases are direct attempts made to determine the relation between pollination and the quantity of seed harvested. The prevailing opinion is that pollination by insects is of vital importance, and that if they are not present in sufficient numbers, the yield of seed is reduced. The importance of the climatic conditions is generally recognized, and it is pointed out that commercial seed is produced in regions with a semi-arid climate, at least during the ripening period.

The flowers of lucerne may be pollinated at any time from the opening of the flower to the fall of the petals. Pollination generally takes place after the release of the staminal tube, which is effected by a special mechanism. The staminal tube is held by two opposite lateral protuberances inside the keel. Heavy insects such as the bumble bee are able to press the sides of the keel apart, thus liberating the staminal tube. Generally, however, the operation is effected by the insect inserting its proboscis between the posterior edges of the keel. More often the two posterior appendages of the wings, which meet above the staminal tube, are displaced, thus causing an indirect distension of the keel. The presence of this spring-like mechanism has been observed in twenty species of *Medicago*, also in *Alysicarpus*, *Trigonella*, *Indigofera* and *Genista*. The writers have not been able to confirm BURKILL'S theory, that the release of the staminal tube causes a rupture of the stigmatic cells and promotes fertilization. Liberating the staminal tube by artificial means, so as not to stimulate or rupture the stigmatic cells by contact, gives as good results as natural pollination.

Flowers which are artificially exploded and thereby self-fertilized produce an abundant crop of seeds. In a series of experiments on 77 plants conducted in 7 different places, 9074 flowers produced 2784 fruits (or 30.66 per cent.) when mechanically self-fertilized, whilst 8939 flowers on the same plants fertilized under natural conditions yielded 1499 fruits (or 16.76 per cent.). The fruits from flowers artificially exploded contained an average of 1.72 seeds each, whilst the fruits of flowers naturally fertilized contained 2.22 seeds.

Cross-pollination among flowers of the same plant is not more productive of seeds than self-fertilization, but pollen from other plants increases the proportion of fruits and the number of seeds per fruit. There is no considerable difference between the pollen of like or of dissimiliar varieties.

The explosion of lucerne flowers normally takes place automatically, but may be caused by insects or other agents. Flowers which fail to open rarely produce fruits and seeds. Two plants were observed at Chinook, Mont., in 1909; one had 57 flowers, of which 33 exploded automatically and set 21 fruits; the other had 64 flowers, of which 36 exploded automatically and set 16 fruits. The percentages of fruits formed from these flowers were therefore 37 and 25 respectively. These figures are as high as those obtained under natural conditions in the fields. In a similar experiment conducted at Pullman, Wash., in 1910, only 21 out of 775 flowers left to themselves produced seed, or 2.7 per cent., against 13.15 per cent. in the open.

There is considerable variation in the rapidity with which the flowers of lucerne explode automatically or by means of exterior agents, and in their subsequent fructification. The number of fruits is not proportional to the number of flowers, since the largest infloresences are less fertile than the smaller ones.

Automatic fertilization of the flowers takes place more frequently during warm sunny weather and is influenced considerably by the humidity. Pollination can be immediately effected by placing the open flowers at the focus of a converging lens or by exposing them to the sun on a warm day. Insects are the natual agents of cross-fertilization of lucerne, but good yields of seed can be obtained in places where they are rare. Bumble-bees and *Megachiles* are the most effective insects for effecting the dispersal of the pollen. Bees collect honey from these flowers, but effect pollination in only a few cases. Nocturnal insects are of negligible importance. There is no evidence to show that butterflies are able to effect pollination; wind and rain are of slight importance.

Automatic explosion of the flower and consequent self-pollination is as effective in producing seed as insect pollinizers, at least in the Western States. This conclusion agrees with the observation that excellent yields of seed are obtained in regions where bumble-bees and other suitable insects are rare.

895 - **Alfalfa in the United States.** — BROOKS, WILLIAM P., in *Massachusetts Agricultural Experiment Station, Bulletin* No. 154, pp. 147-171 + 2 tables. Amherst, Mass., June 1914.

This is a bulletin of instruction and propaganda intended for practical farmers. Part of the directions are based upon the experimental results obtained either by the writer at the Amherst Agricultural Experiment Station or by thirty-three farmers in different parts of the State.

Alfalfa is now successfully grown in most parts of the United States and in a few parts of Canada. It is popularly supposed that alfalfa is much superior in nutritive value to clovers, but so far as can be determined by chemical analyses made at the Amherst Station and determinations of digestibility made there and in other stations, this does not appear to be the case, as may be seen from the following tables :

TABLE I. — *Composition of Clover and Alfalfa Hays.*

	Water %	Ash %	Protein %	Fibre %	Nitrogen free extract %	Fat %
Alfalfa hay	13.24	6.38	13.98	28.48	34.70	1.40
Alsike clover hay	15.00	9.70	14.00	23.10	36.10	2.10
Medium red clover hay	15.00	9.70	13.30	24.30	37.20	2.50

TABLE II. — *Digestible Nutrients and Energy Values* (*).

	Protein (lbs. in 100)	Fibre (lbs. in 100)	N-free extract (lbs. in 100)	Fat (lbs. in 100)	Net energy value (Therms)
Alfalfa hay	10.2	13.9	24.4	0.5	34.9
Alsike clover hay	9.2	11.6	23.8	0.8	34.6
Medium red clover hay	7.7	13.1	24.2	1.4	35.6

(*) Based upon average results in the United States.

The writer does not recommend the direct application of manure in preparing the soil for alfalfa, but advises instead the free use of it on the preceding crops. Sometimes, however, the direct application of potash, lime and phosphatic fertilizers may be advisable. In the writer's experiments potash in the form of sulphate appeared much superior to potash in the form of chloride.

Some varieties of alfalfa introduced from Siberia by the South Dakota Experiment Station have not yet been sufficiently tested. The best seeds of common alfalfa grown in The United States are those from the northern districts ; Grimm's alfalfa is a selected strain which originated in

Minnesota and is noted for hardiness and productiveness (1). In some experiments conducted by the writer with Grimm and common alfalfa, the former yielded an average produce in 3 cuts per year for two years, of 3.982 tons per acre against 3.261 tons of the latter, or a difference of about 22 per cent. in favour of the Grimm.

The variegated alfalfa is said to be a cross between common alfalfa and yellow lucerne. This variety is said to be more hardy than ordinary alfalfa and adapted to poorer soils : it has, however, a tendency to decumbent growth, and a lower feeding value.

Hitherto few diseases have proved troublesome to alfalfa in Massachusetts; the only important ones are leaf-spot (*Pseudopeziza Medicaginis*) and dodder.

Two experiments in inoculation with " Farmogerm " culture (prepared by the Earp-Thomas Farmogerm Co., Bloomfield, N. J.) were made and gave good results on land which was put under lucerne for the first time.

CROPS YIELDING OILS, DYES AND TANNINS

896 – **Methods of Propagation of Olives** (2). — CAMPBELL, C., in *Le Stazioni Sperimentali Agrarie Italiane*, Vol. XLVII, Part 4, pp. 297-307. Modena, 1914.

The writer draws the attention of olive growers to the importance of the methods of propagation. The seeds of the wild varieties of olive have the highest germinating power, but the growth of cuttings (as shown by the writer's experiments) is more vigorous in the case of cultivated varieties and improves as the number of asexual generations increases.

Of the various methods of asexual reproduction, *e. g.* by cuttings, from "ovoli" (3) and by grafting, the last-named method is destined to be of the greatest importance in the future. Reproduction from seed is seldom practised, since the number of seeds which germinate is small, and each stock requires subsequent grafting. The writer remarks that it is possible to improve the germination of the seeds, which is more vigorous in the hardier and semi-wild varieties. The seeds from trees grown directly from seeds are more vigorous in germination than seeds obtained from grafted trees. New varieties obtained in this way, using seeds of the best varieties, will yield seeds with a higher percentage of germination. Since it is necessary to choose vigorous plants as stocks, especially for arid and infertile soils, the writer recommends the sowing of seeds of cultivated varieties so as to produce stocks more suitable for receiving the grafts of their own varieties or others of similar vigour. It will then be possible to undertake on an extensive scale the selection of different varieties, at the same time obtaining useful stocks.

(1) See No. 2106, *B.* July 1911.

(2) See Nos. 2668 and 2669, *B.* Aug.-Sept.-Oct. 1911; No. 1046, *B.* Sept. 1913.

(3) Excrescences formed at the botton of the trunk; these are cut off and planted in the ground like cuttings. (*Ed*)

897 – **Olive Growing in Syria.** — AARONSOHN, A. (Director of the Jewish Agricultural Experiment Station, Haïfa, Palestine), in *Revue Agricole et Viticole de l'Afrique du Nord*, Year 12, No. 120, pp. 607-609 + 3 figs. Algiers, June 27, 1914.

Olives are generally well looked after in Syria, and particularly so about Damascus. The exorbitant prices of irrigated land in this neighbourhood make intensive methods a necessity, and the olive comes in for its full share of attention. While in Palestine grafting is carried out on wild stocks, at Damascus (as at Sfax, for example) cuttings from old trees are grown on their own roots; to promote the growth of shoots from the old stems, the trees are earthed up. Grafting is only performed when it is desired to change the variety.

In preparing the land the soil is not deeply dug over, but very large holes are prepared for the trees, and a layer of stones is placed in the bottom for drainage.

Often very old trees are transplanted. They are cut back almost to the trunk, or at any rate to the oldest branches, and the stumps are dressed with a mixture of clay and dung; the trunk is surrounded by bundles of straw or reeds and a layer of clay and cow-dung. Trees treated like this may remain inactive for two or three years, but once they begin to grow, they develop rapidly and when irrigated begin to fruit in 3 or 4 years.

The trees are planted 16 to 22 yds. apart. When they reach several centuries old, young fruit trees (chiefly apricots of late years) are planted between the rows. When the fruit trees come into bearing, the old olives are removed, realizing about £ 2 each as timber.

The variety most commonly grown is the Dân, with small fruit: the Massa' abi yields large fruit suitable for preserving; the J' lette yields fruit which is consumed in the green state.

Analyses carried out at the Haïfa Experiment Station gave the following figures:

	gms.
Average weight of an olive	3.37
Weight of kernels from 100 gms. of olives	21.75
» oil » »	27.97
» pulp » »	78.75

Pruning, which is little else than trimming, is practised in the Damascus district. The fruit is knocked down by means of long poles.

898 – **Olive Growing in in the District of Tizi-Ouzou, Algeria.** — HIPPOLYTE, L., in *Revue Agricole et Viticole*, Year 12, No. 124, pp. 88-91. Algiers, July 25, 1914.

The western and eastern slopes of the Djurjura chain of mountains are covered with ancient olive groves, the majority of which belong to the Kabyles. The French colonists, encouraged by the bounties for planting and grafting olives granted by the Algerian government, have also begun to plant. The cultivation practised in Kabylia is only ploughing and digging. The importance of pruning is not understood by the native and is seldom practised and then without method. Manures are not applied, and the collection of the fruits is effected by means of poles 2 to 3 yds.

long, which damage the fruits and branches, thus reducing the value of the next year's crop. The writer has introduced a sort of wooden comb, used in some parts of Italy, which enables the fruits to be collected with less damage to the trees.

In the case of the very bushy trees growing in an almost natural condition in the mountains, the first thing to be done is a good thinning. The harvesting of the fruit should be regulated for each district, as the growers are apt to start picking too early, with the result that an inferior oil is produced.

There are two varieties of olives in Kabylia, the Chembal and the Rougette, the latter being more common. The western slope of the Djurjura is favoured by abundant rain, averaging 45 to 50 inches per annum. These conditions are very favourable to the future welfare of the industry in this region. The adoption of modern rational methods would result in immediate improvements and a yearly crop instead of one every other year.

899 – **The *Aleurites* of Tonking.** — LEMARIÉ, CH., in *Bulletin économique de l'Indo-Chine*, Year 17, No. 107, pp. 144-150. Hanoï-Haiphong, March-April, 1914.

The writer gives a description and botanical analysis of the species of *Aleurites* of Tonking, with references to others from China and Japan. " Cây-trau " of Tonking was first described as *A. cordata* Muel. Arg.

Eberhardt recorded *A. Fordii* Hemsl. as occurring in the remote province of Tonking. The only species found by the writer in the Delta and forest regions are *A. triloba* Forst. (*A. moluccana* Willd.) or "cây-lai ", and *A. montana* Wils. or " cây-trau ", of the latter of which he gives a botanical description.

E. H. Wilson (*Bulletin of the Imperial Institute*, Vol. XI, No. 3), mentioned that the species which yield a drying oil used for waterproofing objects, varnish, linoleum and rubber substitutes, etc., occur on the continent, while the Japanese species, *A. cordata* Muel. Arg., yields a burning oil.

Enormous quantities of drying oil are exported to Europe and America. Thus, in 1900, more than 330 328 pikuls (about 44 million lbs.) of oil obtained from *A. Fordii* were exported from Hankow, valued at 2 559 344 Haikwan taels (about £ 320 000), and in 1910 as much as 757 959 pikuls (about 100 million lbs.) valued at 6 449 421 taels (or £800 000). The exports from Outcheon during the same period increased from 24 469 pikuls (or 3 million lbs.) of oil from *A. montana*, valued at 146 813 taels (or £19 000), to 52 106 pikuls (7 million lbs.)

A. montana Wils. is limited to the subtropical regions in the south-west of China, from Fukien to Annam. *A. Fordii* Hemsl., which yields more than $^{9}/_{10}$ of the total production of oil, belongs to the warm temperate regions of the Yangtse basin. *A. montana* is much more productive in Fukien than in Tonking, where the writer suggests improvement of the variety by selection. He also recommends experiments with *A. Fordii* on the high plateaus of Tonking, as this species is more productive and the fruits are devoid of a ligneous seed-coat.

900 — **The Cultivation of the Sugarcane in the South of Spain.** — *Royal Botanic Gardens, Kew, Bulletin of Miscellaneous Information*, No. 4, pp. 147-150. London, 1914. SUGAR CROPS

This article is based on information received from the British Consul at Malaga.

Sugarcane is cultivated in the sheltered valleys between Estepona and Adra. The most profitable varieties are: Blanca, sometimes called Amercana, imported by the Arabs; Marada (violet) and Negra (black), probably the same variety: Negra is said to have been imported from Cuba; Canna cristalline, larger than the preceding but less rich in sugar; Striée, of inferior quality; Algarrobena, now almost entirely abandoned.

The preparation of the land consists in heavy manuring and careful cultivation, breaking of clods, levelling, preparation of furrows 35 inches wide and about 8 inches deep, for the planting of the sprouted cuttings in March and April. They are planted in 3 lines so that the cuttings of one line alternate with those of the adjacent lines. They are covered with a light layer of soil and gradually earthed up as they grow until the ground is level again. The land is kept free from weeds and in July or August guano or chemical manures are applied followed by irrigation for 15 to 20 days until harvest. The plantation is renewed every 7 to 8 years or 10 to 12 years. The use of a complete chemical manure has become very widespread of late years, as much as 1350 lbs. per acre being applied once or twice during the season.

The average yield is 20 tons p. acre and the average sugar content for the district is 14 % and at Adra only 8 %.

901 — **Sugar-Beet Experiments in Ireland.** — *Department of Agriculture and Technica. Instruction for Ireland, Journal*, Vol. XIV, No. 3, pp. 471-482 + 4 figs. Dublin April 1914.

In 1911 the Department of Agriculture and Technical Instruction for Ireland commenced a series of sugar-beet experiments with a view: 1) to comparing the relative yields and quality of roots grown close together in rows on the flat in accordance with continental practice, and of those grown wider apart on drills or ridges, so that after-cultivation was facilitated; and 2) to affording information as to the yields of this crop in the state in which it is purchased by sugar factories, *i. e.*, of roots properly topped and cleaned.

In the 1911 experiments the farmers reported very adversely on the systems of growing sugar-beet on the flat, because it was more costly and the crop more difficult to lift than when the beet was grown on drills. In order to ascertain whether the requirements of a sugar factory for roots grown almost entirely below the surface of the soil could be met by cultivating the crop on moulded-up drills, a third plot cultivated in this manner was included in the trials in 1912. Furthermore, in 1912 half of each plot was top-dressed with nitrate of soda. The experiments in 1912 were conducted at twelve centres in eleven counties.

In 1913 the experiments of 1912 were repeated: *a*) on drills 27 inches wide; *b*) on drills 27 inches wide — the crop being moulded up after hoeing;

c) in rows 18 inches apart on the flat; *d*) with and without nitrate of soda at the rate of 1 ½ cwt. per acre.

The area of each plot was one-tenth statute acre: the variety of sugar-beet used was Klein-Wanzleben Original Z.

The average yields of the three seasons 1911-13 (30 experiments in all) were as follows:

Ordinary drills:

Gross weight of roots	15 tons 9 cwt. per acre
Factory weight of roots	11 » 1 » »
Sugar content	17 per cent.

On the flat:

Gross weight of roots	16 tons 12 cwt. per acre
Factory weight of roots	13 » 2 » »
Sugar content	17.5 per cent.

From the above it is evident that the better crop in point of yield and also of sugar content was that cultivated on the flat, and that, moreover, the superiority of the roots on the flat would, at a price of £1 per ton on the farm, more than recoup the extra cost of labour involved in this method of cultivation.

The average yields in 1912 and 1913 are shown in the following table:

Plots	Average annual yield of roots per acre				Ratio of factory weight to gross weight as percentage	Average sugar content, per cent.	Average coefficient of purity (apparent)
	Gross weight		Factory weight				
	tons	cwt.	tons	cwt.			
Ordinary drills:							
a) Without nitrate of soda	13	6	9	8	68.1	16.5	89.45
b) With » »	15	1	10	3	67.4	16.1	89.24
Moulded-up drills:							
a) Without nitrate . . .	14	1	10	3	72.0	16.3	89.42
b) With » . . .	15	11	11	4	72.0	16.2	89.55
On the flat:							
a) Without nitrate . . .	14	14	10	17	73.8	17.0	89.60
b) With » . . .	16	10	12	1	73.0	16.5	89.28

From the above table it will be seen that, on the average of the two seasons, the flat plots *a* and *b* produced yields (factory weight) only 14 and 17 cwt. respectively per acre higher than the moulded-up drill plots *a* and *b*, and that the sugar content of the roots on the former plots was only 0.7 per cent. and 0.3 per cent. respectively higher than that of the roots on the latter. These increments in yield and sugar content would by

no means be sufficient to compensate for the extra outlay in labour on the lat plots. It may therefore be inferred that of the three methods of cultivation that of moulding up ordinary drills is best adapted to Irish conditions.

It will be noticed also in the above table that the average increases in yield (factory weight) due to the application of nitrate of soda were as follows :

On ordinary drills	15	cwt.	per acre
On moulded-up drills	21	»	»
On the flat	24	»	»

and that, on the average, the use of nitrate of soda slightly reduced the sugar content of the roots (the reductions being 0.4, 0.1 and 0.5 per cent. respectively). Nitrate of soda had little, though varying, effect on the purity of the juice.

From the foregoing it would appear that the application of nitrate of soda to sugar-beet would not prove remunerative on fields manured as the experiment plots of 1912-13 had been. Some of them had 15 tons of farmyard manure to the acre and 1 cwt. sulphate of ammonia, 3 cwt. of superphosphate and 6 cwt. of kainit, and others only chemicals, namely 1 ½ cwt. sulphate of ammonia, 4 ½ cwt. superphosphate and 6 cwt. kainit.

In some localities the sugar-beet plots were grown alongside mangolds with a view to comparing the relative yields. The general averages of nine experiments in the three years 1911-13, the yields of the best plots being taken, were the following :

Sugar-beets (gross weight) . .	17	tons	9	cwt.	per acre
» (factory weight) .	13	»	10	»	»
Mangolds	28	»	18	»	»

The average yield of mangolds at the same time was 19 tons 3 cwt. per acre. This shows also that the farmers who carried out these sugar-beet experiments were among the best. The inference to be drawn from these facts is that, even when cultivated in the best manner, the factory weight of a sugar-beet crop in Ireland cannot be expected to exceed about half the yield of a well-managed crop of mangolds.

902 – ***Coffea excelsa* and its Cultivation.** — CHEVALIER, AUG., in *Journal dAgriculture Tropicale*, Year 14, No. 157, pp. 193-196. Paris, July 31, 1914.

STIMULANT, AROMATIC, NARCOTIC, AND MEDICINAL CROPS

The writer discovered this species of coffee in Central Africa and distributed seeds to several experiment stations, including those in Tonking, Java, French Guinea and the Belgian Congo.

Native climate. — *C. excelsa* is found in the wild state at altitudes of 2 200 ft. in a climate which is dry for six months of the year and has a rainfall of at least 40 inches during the remaining six months. The summer temperature is tropical, whilst in December and January it falls below 10° C. at night. This type of climate occurs in a number of countries. It has been shown that this species succeeds well in equatorial regions, so that its cultivation is possible over wide areas.

Quality. — The coffee obtained from Central Africa showed a satisfactory strength in caffein, and though somewhat bitter it had an excellent flavour.

Introduction in Tonking and Java. — In Tonking its growth has been remarkable and entirely free from insect and fungoid pests. The bean is small and uniform in size and it is hoped to sell it in competition with Arabian coffee blended with Mocha. Numerous specimens have been planted in Java in the Experiment Station at Bangilan near Malang and in the Tjikeumeuth Garden near Buitenzorg. Field cultivation has also been begun in the Dutch East Indies.

Selection. — This species is being improved by M. P. J. S. Cramer. It shows variation in almost all its botanical characters. In appearance it is less luxuriant than *C. liberica,* though it is hardier and earlier.

Cultivation. — This species is particularly robust in Java. It commences to flower in the second year and yields a crop of berries in the third year. The trees should be planted at least 12 ft. apart each way. Each tree is planted in the centre of a square plot cultivated and made to slope in the opposite direction to the general slope of the land and forming a hollow at the lower end, so as to prevent erosion of the surface soil. Young plants of "lamtoro" (*Leucaena glauca*) are planted on the border of each square and periodically pruned so as to prevent the growth of old shoots. Stumps of *Leucaena* 16 inches high are planted at the four corners of the squares at the same time as the coffee plants. They are allowed to grow freely until the fifth year, when they are cut down; as the coffee plants now cover the ground the *Leucaena* along the borders of the squares and some of those at the angles are removed so as not to shade the coffee too much.

Yields. — At Bangilan an annual yield of 616 lbs. per acre or about 3 lbs. per tree has been obtained. M. Cramer mentions the plantation at Kedatong (South Sumatra) where 54 plants of *C. excelsa* of 4 to 5 years growth yielded 7 lbs. per tree.

Market Value. — The value of the coffee approaches that of Liberian coffee and according to M. Boom it amounts to about £ 20 per acre. The beans require particular care since they are enclosed within a thin skin which must be completely removed before the highest prices can be obtained. Unfortunately only a small supply of the best strains exists and it is only at Bangilan that a uniform collection has been seen by the writer.

903 – **Studies on the Fertilization of Hops.** — TOURNOIS, JULIEN, in *Annales des Sciences Naturelles, Botanique,* Vol. XIX, No. 2 and 3, pp. 49-491 — 5 plates. Paris, June 1914.

Investigations of the various phenomena in the sexual reproduction of *Humulus Lupulus* and *H. japonicus.*

I. *Appearance of flowers and differentiation of the sexual organs.* — The time of flowering depends strictly on external factors; changes, for example of illumination, may cause considerable variation in the duration of the vegetative period.

The species of *Humulus* are generally dioecious, though apparently monoecious individuals occasionally appear. The transformation of dioecious plants is brought about by particular conditions, especially those

which diminish the transpiration of plants, or tend to lower the osmotic pressure. It appears that a lowering of the osmotic pressure of male plants may determine the appearance of female organs or flowers and that an increase of osmotic pressure in female plants may provoke, though more rarely, the development of male organs or flowers.

II. *Fertilization and formation of the embryo.* — The ovule of the common hop may be fertilized by foreign pollen, such as that of hemp and of Japanese hop, but in these cases the resulting seeds contain only irregular abortive embryos.

III. *Formation and constitution of the fruit or cone of the common hop.* — Fertilization is not essential to the development of the cones, but it stimulates their growth. The various morphological characters of the cone which form the basis of classification of hops, are liable to variation under different conditions and are of no more value than vegetative characters in determining the varieties. Consequently the species *H. Lupulus* is to be considered homogeneous, notwithstanding the innumerable varieties of cultivated hops that have been described.

This monograph comprises 7 chapters and contains a very extensive bibliography. It concludes with generalizations concerning the determination of sex and the phenomena following pollination of the common hop with pollen from very different species. The following information on the different varieties of cultivated common hop is taken from Chapters VI and VII.

The influence of fertilization on the development of the cones is seen in their more rapid growth and greater size. The yield, excluding seeds, is doubled. The bracts of unfertilized cones are more adherent and by remaining intact during manipulation they retain the lupulin to a greater extent, whilst the fertile cones readily drop their bracts with a view to seed dispersal. It is generally believed that fertilization results in a lowering of lupulin content. The writer, however, is of opinion that the number of glands will remain the same in both types of cone and that only reduction in the relative number of glands owing to the increase in surface area of the bracts would account for the loss of strength. The only advantage, but a very important one from a commercial point of view, is the increased yield of cones after fertilization. The chief disadvantages are: greater fragility of the cones and loss of lupulin, and perhaps also reduction in strength of lupulin.

In Belgium and America, and to some extent in England, it is the custom to plant one male hop for every two or three hundred female plants, whilst in Germany, Bohemia, the East of France and Burgundy all male hops are carefully destroyed and often the local authorities forbid their cultivation. It will only be of advantage to the grower to plant male hops in his fields so long as the increased crops are not compensated for by a lower price for the dried hops.

Male hops should be planted in countries where a cool and damp climate retards the more complete utilization of the plant reserves and where

the growth of the cones is retarded by unfavourable conditions, such as extreme drought or attacks of aphis.

In reviewing the characters of the different varieties, it is only possible to compare specimens of the same variety from different districts. The characters of the cone are as follows : aroma, the character most considered by the brewers, but which has not yet been put on a proper scientific basis : shape of the cones, which varies on the same plant : percentage of seeds, indicating the extent of fertilization : the shape of the bracts, biometric measurements of which might form a suitable basis for classification ; the presence of leaves in the cones, an anomaly which appears frequently in certain varieties and which occurs in other varieties in certain favourable seasons. The varieties in which this abnormality appears most frequently yield products of good quality, but are less productive, and when the character is too pronounced there is an excess of material devoid of lupulin, which may even import an inferior taste to the beer.

Other characters which are noted are : the productivity, depending chiefly on the cultivation ; the degree of precocity, depending on illumination and general climatic conditions ; the colour of the stems and shoots, which does not appear to be a fixed specific character.

None of the characters studied appear to be hereditary and they are of no use in defining species or varieties. Each of the cultivated forms appears to correspond to a single individual or to a small number of individuals divided into innumerable parts by means of setts. It is therefore concluded that the specials *Humulus Lupulus* is very homogeneous and that the various cultivated forms (of which BRAUNGART has enumerated 200 from all parts of the world) are only individuals with slight differences.

904 – **Essential Oil of *Ocymum pilosum* Roxb.** — BHADURI KSHITIBHUSAN, in *The Journal of the American Chemical Society*, Vol. XXXVI, No. 8, pp. 1772-1773. Washington, D. C., August 1914.

The essential oil is found in every part of the plant including the seeds, from which, however, it can only be obtained by distillation when they are fresh. The essential oil obtained by distillation in a current of steam is a very mobile liquid, of a light yellow colour ; on exposure to the air it volatilizes leaving behind a resinous mass possessing a smell almost identical with that of the essential oil of lemon-grass. Its specific gravity is 0.8872 at 25.5° C ; its refractive index is 1.4843 or 40° 12' at 24.5° C. ; laevogyre, with specific rotary power $[\alpha]$ D = - 4° 10' 14" at 24.5° C.

Its chemical reactions prove that the essential oil contains aldehydes (75 per cent. by volume, of which 41 per cent. is citral and 34 per cent. citronellal), cineol, limonene, and very small quantities of thymol ; it does not contain free acids ; on being treated with strong mineral acids it evolves the smell of camphor.

905 – **Medicinal Plants in Tunis.** — CUÉNOD, A., in *Bulletin de la Société d'Horticulture de Tunisie*, Year 13, No. 82, pp. 186-189. Tunis, May 15, 1914.

The natural habitat and uses of the following plants are indicated : *Adonis microcarpa*, *Aloe vera*, *Aceras anthropophora*, *Althaea officinalis*, *Anethum graveolens*, *Apium graveolens*, *Artemisia arborescens*, *Borago offi-*

cinalis, Callitris quadrivalvis, Colchicum autumnale, Lavandula multifida, Mandragora autumnalis, Matricaria aurea, Melissa officinalis, Mentha viridis, Papaver somniferum, Pinus halepensis, Rosmarinus officinalis, Sinapis alba, Thapsia garganica, Trigonella Foenum-graecum, Thymus capitatus, Urginea maritima, Verbena officinalis.

906 – **A New Cover Crop: *Dolichos Hosei.*** — CRAIB, W. G., in *Royal Botanic Gardens, Kew, Bulletin of Miscellaneous Information*, No. 2, pp. 76-77. London, 1914. VARIOUS CROPS

The writer gives a botanical description of a new species, *Dolichos Hosei* Craib, obtained from the Experimental Plantation, Kuala Lumpur, F. M. S. The value of this plant was first noted by Mr. E. Hose, who found it a great success as a cover crop at Sarawak, Borneo.

The plant is indigenous in Borneo. It thrives on all soils but, prefers a sandy loam. It forms a thick dense growth about 6 inches deep and when planted 3 feet apart in six months it prevents the washing of the soil. Seed is difficult to obtain and propagation is readily effected by means of cuttings.

907 – **Studies on the Chemical Composition of Mulberry Trees in Japan.** — KAWASE, S., and SAITO, R., in *Bulletin de l'Association séricicole du Japon*, Year 1, No. 8, pp. 7-11. Tokio, April 1, 1914.

The writers give the results of their experiments carried out since 1912 at the special School of Sericulture at Uéda.

I. — *Chemical changes during the growth of mulberry leaves.*

As the result of numerous analyses the following conclusions have been drawn :

1). The percentage of water decreases in proportion to the development of the leaves, whilst the percentage of dry matter increases.

2). The percentage of protein in the dry matter and the fresh leaves decreases in proportion to the development of the leaves.

3). The percentage of crude fibre in the dry matter and fresh leaves increases enormously in proportion as the leaves develop.

4). The percentage of nitrogen-free extract increases as the leaves develop.

5). The percentage of the various nitrogen compounds, albuminoid, ammoniacal, amino, etc., diminishes as the leaves develop.

II. — *Differences in the chemical composition of leaves on standard and dwarf trees.* — Experiments were conducted on only one variety, *Komaki*, and show that :

1). The percentage of crude fat, protein and lime is higher in leaves of standards than in those of dwarfs. The percentage of nitrogen-free extract is higher in the leaves of standards. The quantity of phosphoric acid and ash is almost constant.

2). The composition of the leaves on young branches shows no considerable differences in the two types of trees.

3). In the case of old branches, the percentage of crude protein, fat and ash is higher in standards than in dwarfs, but the percentage of nitrogen-free extract and crude fibre is higher in the case of dwarf trees.

III. *Manner of calculating the quantity of manure suitable for the mulberry* This is based on the results of the preceding analyses and is only strictl applicable to this one variety Komaki. Other investigations with differen varieties of mulberries under different conditions are in course of progres in order to determine more general conclusions.

FRUIT GROWING

908 – **The Cultivation of European Fruit Trees in Upper Tonking.** — CHEVALIE AUGUSTE, in *Bulletin économique de l'Indo-Chine*, Year 17, No. 107, pp. 107-113. Hano Haiphong, March-April 1914.

The region to the north of the delta of the Red river in Tonking ha a temperate climate during the greater part of the year, whilst in th uplands it is distinctly cold during the three months November to January During the months from April to July the temperature rises considerably especially at altitudes less than 1000 ft. The climate, however, is favourabl to the growth of many European plants, including the following fruit trees

Citrus s· p. (oranges, lemons, mandarins, pomeloes). Numerous varietie occur near Tonking. The better varieties are propagated by means of air layering. Grafting is never practised by the Annamese, but they under stand the methods of growing dwarf trees, and sometimes treat citrus tree in this way.

The *persimmon* appears to have been introduced a considerable time but is not yet very widely distributed. It produces many excellent fruits The writer observed two varieties: one, small and seedless, the other muc larger and containing 5 or 6 seeds.

The *pomegranate* was introduced before the French occupation, bu it is chiefly cultivated as an ornamental plant.

Peaches are widely distributed, especially in the north and east, and ar often found half wild. It is chiefly cultivated for its flowers rather tha its fruits, which are generally of inferior value. A variety of bette quality is found the mountainous region inhabited by the Thôs, west o Lao Kay, and in Yunnan on the frontier. The acclimatisation of goo European varieties has already been succeessfully attempted at Cha-F at altitudes between 4000 and 5000 ft.

Plums exist in a wild state near the Chinese frontier. There are tw varieties in the Langsom district, one resembling the mirabelle and the oth the common plum. Another species of wild plum was met with in th Lang Biang mountains.

The *pear* (*Pyrus sinensis*) is commonly cultivated in the South of Chi in the district of Langsom (Tonking). Its fruits are handsome in appea ance, but of poor quality. There is little prospect of improvement b selection, but something might be done by hybridisation and graftin (*e. g.* on the wild stock of the Langsom district).

Apples are not grown by the natives in Tonking, but Yunnan alread sends them to Hanoi. French varieties have been acclimatised at Cha-P A species of wild apple (*Pyrus Doumeri* Bois) has been found in Annam south of Tonking, on the uplands of Lang-Biang: this should be usef as a stock for grafting European varieties.

The European *vine* was apparently unknown in Tonking before the French occupation. It does not give good results and is often attacked by disease, notably oidium. In the *Flore d'Indo-Chine* (Vol. I, Part 8, 1912) M. GAGNEPAIN records 4 species of *Vitis*, two of which, *V. balanseana* Planch. and *V. pentagona* Diels and Gilg., occur chiefly in Tonking and produce edible grapes.

Figs have been successfully introduced and thrive in Tonking even in the Delta region. They multiply readily and yield an abundance of fruit.

Several species of *blackberry* are found in the wild state in Tonking and in the south of China. The *raspberry* has been successfuly introduced and fruits freely.

Red currants and *gooseberries* have also been introduced by M. Miéville at Cha-Pa, and produced fruits during 1913. Other fruits introduced are apricots, quinces, nectarines and walnuts.

The *sweet chestnut* probably exists in certain parts of Yunnan, but it has not been recorded in Tonking. Several wild species of *Castanopsis* occur and one of them is cultivated for its fruits.

Several varieties of *strawberries* are cultivated on a large scale by native market gardeners near Hanoi. The writer found a wild strawberry at Cha-Pa producing fruits without either flavour or smell and another producing fairly tasty white fruits.

It appears that almost all the fruits of the temperate zone can be cultivated in Tonking, but the productive plants are scarcely introduced or are represented by species or varieties different from those cultivated in Europe and generally inferior. The natural advantages of Tonking over those of other neighbouring countries, will enable it to supply European fruits to the markets of the Far East. The imported French varieties do not always maintain their qualities ; the flavour is always different, sometimes improved, but generally inferior. The improvements require a long time and are generally the result of new varieties obtained from seed. Researches on the acclimatisation of suitable European fruits can be carried out only by a properly constituted Agricultural Service.

909 – **The Propagation of the Date Palm.** — CORNELL, RALPH, in *Pomona College, Journal of Economic Botany*, Vol. III, No. 1, pp. 418-423 + 3 figs. Claremont, Cal., February 1913.

The first date palms were imported by the United States Department of Agriculture twenty-five years ago, but it is only recently that the propogation of this palm in the arid regions of the south-west has assumed commercial importance. At the present time private enterprise has planted a nursery of 15 000 palms in the Colorado desert. The cultivation of this palm is limited to this region, Chuckarvalla, Mesa de Palo Verde, Imperial Valley, Yuma, Arizona and the region of Phoenix and the Salt River Valley.

The shoots or suckers, which may weigh anything from 10 to 50 lbs., are severed from the parent tree by means of heavy chisels specially made for the purpose. After painting the severed butt ends of the shoots, their tops are trimmed and the whole plant is wrapped and sewed in a covering

of palm fibre preparatory to shipment. They are often packed in boxes to facilitate handling on their long journey, during which they must be kept sufficiently moist to present excessive drying, but not so damp as to encourage mould or rot. At the end of their journey the Department of Agriculture requires that they be immersed for two different periods of 15 minutes each in an insecticide of given formula. They must then be planted in nursery form in an isolated place at least 1000 ft. from any other date palms and remain thus quarantined for 12 months. Before the planting takes place they are left exposed to the burning heat of the sun for two days so as to dry them thoroughly and stop any fungous growth that may have started. The young palms are planted so as to lean slightly toward the prevailing wind, in rows 4 feet apart and 3 feet apart in the rows. They must be kept continually moist and are generally watered every other day for the first six weeks. After this time the frequency of the irrigations may be gradually diminished as the young shoots establish themselves in their new home, but the plants should never be allowed to approach a state of dryness. The rooting process is slow and requires 8 or 9 months, sometimes even a year. The percentage of survivals varies considerably, but is generally considered satisfactory.

910 – **Date Palms from Irak.** — POPENOE, PAUL B., in *Pomona College of Agriculture Journal of Economic Botany*, Vol. III, No. 2, pp. 459-477. Claremont, Cal., May 1913.

Irak contains the largest area in the world under date cultivation, and its produce, known as Persian Gulf dates, has monopolised the North American markets for a long time. Nevertheless, when date cultivation began to assume economic importance in California, the material for the new plantations was imported from Algeria, as being more easily accessible. Most of the varieties thus obtained ripen late and the harvest in certain districts is often damaged by rain. Further, they reach the markets after they become dominated by the produce from Irak. It is therefore of great importance to obtain early varieties ripening in August and September. The Department of Agriculture obtained several such varieties from Irak in 1913.

In obtaining these varieties the writer visited Oman, Busreh and Bagdad during the winter of 1912-13. He catalogued and described 112 varieties previously unknown, and about 9000 suckers were shipped for propagation.

A description of the above varieties is given in this article.

911 – **New Fruits on North American Markets.** — *The Journal of Heredity*, Vol. IV No. 4, pp. 179-184 + 3 figs. Washington, April 1914.

The so-called "Pili nuts" which have been sold on American markets for many years at about 28 cents per lb. are the fruits of *Canarium ovatum* and *C. luzonicum* from the Philippines, and to a less extent of *C. commune* from the Dutch East Indies. The first two species exist in a wild state, while the third is cultivated. These trees (which also yield an oleo-resin) would be difficult to acclimatise in the United States but would be more suitable to Central and South America.

The Paradise nut is the fruit of various species of *Lecythis*, chief

L. Zabucajo, cultivated in Brazil, Venezuela, and Guiana. It is sold in the United States at about 80 cents per lb.

The Queensland nut is the fruit of *Macadamia ternifolia* and is already being experimented with in the south of California and other warmer regions of the United States, where it promises to become of considerable industrial importance.

912 – **The Influence of Chemical Manures on the Keeping Qualities of Pears.** — RIVIÈRE, GUSTAVE, and BAILHACHE, GABRIEL, in *Journal de la Société Nationale d'Horticulture de France*, 4th Series, Vol. XV, pp. 435-438. Paris, June 1914.

These experiments were conducted with pears of the variety Passe-Crassane, from July 5 to August 30, 1913. A row of 12 trees was chosen, four of which were used as a control and received no application; the next four trees received 10 litres of water each week and the remaining four received 10 litres of a solution containing 1 gm. of the double phosphate of potash and ammonia per litre. The fruit was harvested on October 18 and stored until fully matured, when it was analysed. The results were as follows.

1) In each group the number of fruits per tree was approximately the same (22 to 25); the volumes and weights varied slightly (383, 333 and 366 gms.).

2) The application of manures does not injure the keeping qualities of this variety (Passe-Crassane), since the fruit of the manured trees remained good longer than that of the others.

3) Manuring did not affect the chemical composition of the fruits to any considerable extent.

913 – ***Eremocitrus*, New Genus of Citrus Trees from Australia.** — SWINGLE, WALTER E., in *Journal of Agricultural Research*, Vol. II, No. 2, pp. 85-100 + 7 figs. + 1 table. Washington, May 1914.

The writer gives the botanical description, distribution, morphology phylogeny and mode of culture (grafting, hybridising and selection), of *Eremocitrus glauca* Swingle (syn : *Triphasia glauca* Lindl. ; *Atalantia glauca* Benth.) indigenous in the north-east of Australia. It is a spiny shrub, showing a marked morphological adaptation to desert conditions and characterised by a winter resting-stage and absolute resistance to cold. Its fruits are small, pyriform or roundish, and edible. It grafts easily with all common cultivated citrus trees.

914 – **Hybrid Direct-Bearers in the Côtes-du-Rhône District (France) in 1913.** — DESMOULINS, AMÉDÉE, and VILLARD, VICTOR, in *Le Progrès Agricole et Viticole*, Year 35, Nos. 29 and 30, pp. 81-89 and 108-111. Paris, July 19 and 26, 1914.

After a series of observations made in 1913 on Couderc, Seibel and other hybrids, the writers conclude that among the many varieties obtained by hybridizing there are a certain number which are decidedly valuable. The recent hybrids obtained are much superior to the earlier ones, as the writers have seen in studying the question during the last fifteen years. Nevertheless the writers do not think it possible at present to utilize hybrid direct-bearers for the great wines, which for the moment

must limit themselves to fine local grafted stocks. On the other hand these hybrids may be adavantageously employed in districts which produce only common wines ; thanks to them the production of fairly good wines of current consumption becomes steadily more reliable and its cost price cheaper.

Their functions, according to M. Couderc, are : 1) to allow the vine to be grown in localities in which it is not the principal crop ; 2) to get a crop in years in which there is much mildew and wine is dear (a kind of insurance) ; 3) diminish expenses when wines are cheap.

As for the question whether these hybrid direct-bearers are to be grown on their own roots or grafted, the writers believe that there is evidently more safety in grafting them, but that the following direct-bearers may be grown on their own roots on the soils mentioned below :

1. *On very dry soils* : Couderc 123-11, C. 7120, C. 202-75, C. 106-46, C. 272-60, Seibel 1000, Berthille-Seyve 450.

2. *In medium soils* : Seibel 2007, Castel 1028, Castel 13-706, Gaillard 157, Berthille-Seyve 618.

3. *In good soils* (wheat soils) : first the varieties mentioned above as suitable for medium soils, and then Seibel 1, S. 128, S. 880, S. 2660, S. 2653, S. 4111, Malègue 474-5.

The writers have also studied the dates of shooting of direct-bearers, which it is important to know, since spring frosts may injure vines which open early. It is evident that in districts liable to late frosts, other conditions being equal, late varieties are to be preferred. The susceptibility of a variety to spring frosts is not necessarily due to early shooting, as other factors may modify this sensibility. The time at which the buds open is also affected by various factors, but at the same time should be considered in the choice of a hybrid.

By measuring for each variety at the same period (15th to 22nd of April) the same number of shoots and taking the average of such measurements, the writers have established for each hybrid the average length of the shoots, by means of which they could measure the difference in shooting of the varieties under comparison. The results of these measurements are here given :

Length of shoots between 15th and 22nd of April	Group
1 or 2 cm.	late
3 or 4 cm.	medium
5 or 6 cm.	early
7 cm. or more	very early

STRY 915 — **The Alpine Limits of Forest Growth.** — D'ALVERNY, A., in *Annales de la Science Agronomique*, Year 3, No. 6, pp. 273-294. Paris, June 1914.

The question as to why the upper limits of forest growth are higher in the centre of mountain groups than on the outside has still reeceived no satisfactory answer.

The two principal explanations attempted are based on temperature and atmospheric precipitations respectively. FLAHAULT inclines to the latter

factor and in order to explain the phenomenon, distinguishes between the subalpine belt with maximum precipitation, and the alpine region proper. The great moisture-laden currents of air which strike the mountain ranges follow the average slope of the continent inland; the parallel layers, laden with varying amounts of moisture, rise gradually as they approach the high mountain masses. But the maximum of precipitation supposed by this theory is not at all demonstrated; all that the records show is that the first chains of mountains act as a screen to the inner masses and prevent a greater rainfall there. It is further to be noted that Flahault's botanical characterization of the subalpine zone (presence of *Pinus Cembra*, *P. uncinata*, *Larix europea* and *Picea excelsa*) is somewhat artificial; in particular, spruce agrees more nearly with silver fir in not reaching the tree-limit where this is highest.

According to Dr. MAREK the alpine limits of forest growth are lower where the annual sum of precipitations is highest. This conclusion, which seems paradoxical and in contradiction with the laws of plant biology and with current observation, is nevertheless justified if instead of considering only moisture it be admitted that other factors contribute to this result. Since all the study which has been based on the influence of temperature has yielded insufficient results not agreeing with each other, Dr. Marek sees in the factor light the one which more especially justifies the paradoxical aspect of his law. The factor light must therefore be studied with attention in its effects and must be subjected to accurate measurements (1).

The study of alpine limits would be more complete if the three essential factors of plant life—light, moisture and heat—were all considered together. It would then be seen that trees begin to fail where, owing to the want of heat, and notwithstanding the light, growth becomes so slow that it does not counteract the effect of drought. They disappear when the time is too short for the seedlings to produce during the growing season a sufficient formation of wood to afford protection against the injury caused by cold.

The fruiting of trees diminishes as their situation becomes colder, and this decrease is more marked in clouded and moist positions. It is thus evident that the warm and sunny localities of the central ranges are more advantageous than the spurs or outer chains; this is one of the most important reasons of the difference of level of the alpine limits of forest vegetation.

LIVE STOCK AND BREEDING.

916 – **Studies on the Toxicity of Cicuta or Water Hemlock.** — MARSH, C. DWIGHT, and CLAWSON, A. B. (Bureau of Plant Industry); and MARSH, HADLEIGH (Bureau of Animal Industry); in *Bulletin of the U. S. Department of Agriculture*, No. 69, 27 pp. + 4 plates. Washington, March 1914. HYGIENE

The writers give an introductory account of the historical works dealing with *Cicuta*, a list of its poisonous species, its resemblance to *Conium*, and its pathological effects.

(1) See also No. 893, above. (*Ed.*).

Experiments were conducted in 1910 and 1911 with specimens of *Cicuta occidentalis* occurring in irrigated land in the Ohio Creek Valley, Colorado. Sheep and young cattle were used to determine: 1) whether the plant is poisonous in summer and early autumn; 2) the danger to live stock from eating hay containing *Cicuta*; 3) the symptoms and effects of *Cicuta* poisoning.

The conclusions of the writers are as follows:

1. The synptoms of *Cicuta* poisoning are characterized by nausea, pain and violent convulsions. The prominent lesions, as found in autopsies, are congestion of the lungs, kidneys, and central nervous system, with inflammation of the alimentary canal.

2. So far as is known all the higher animals are susceptible to *Cicuta* poisoning.

3. A very small quantity of the root may be fatal, but the amount varies with the season and the period of time during which it is eaten. The plant is very poisonous at all stages of its growth.

4. The toxic principle is largely confined to the rootstock; the tops under ordinary circumstances are not poisonous and neither the tops nor the seeds are dangerous when present in hay.

5. The best remedy is an emetic; hypodermic injections of morphin (from 1 ½ to 3 or even 10 grains in the case of larger animals) are recommended to control the convulsions.

The following species of *Cicuta* are reported as poisonous: *C. maculata, C. bulbifera, C. vagans. C. Bolanderi, C. occidentalis, C. californica, C. Curtisii, C. Douglasii, C. purpurea, C. tenuifolia* and *C. virosa.* There is every reason to believe that all species of *Cicuta* are poisonous, and possibly all equally so.

A full bibliography of *Cicuta*, comprising 49 works, is appended.

917 – **Experimental Investigations into the Cause of Pernicious Anaemia or Typhoid Anaemia in Horses.** — SEYDERHELM, K. R. (Director of the Municipal Slaughterhouse, Strassburg) and SEYDERHELM, R., in *Berliner Tierärztliche Wochenschrift*, Year XXX, No. 34, pp. 609-612. Berlin, August 20, 1914.

CARRÉ and VALLÉE demonstrated and VON OSTERLAG and MAREK confirmed that infective pernicious anaemia in the horse is caused by an ultra-visible virus present in the blood, faeces and urine. There remained, however, some doubts as to the manner in which infection took place, as it was observed that in order to procure infection by food soiled with excrements such quantities of these were necessary as to preclude its happening in practice. It was further observed that only in very rare instances did healthy horses contract the disease through living alongside of sick ones. On the other hand it has been observed that very often the appearance of the disease followed on the horses being put out to graze. Consequently the hypothesis has been advanced of the existence of an intermediate host of the pathogenic agent. Various writers have suspected intestinal parasites, flies, and ticks of playing the part of intermediate hosts, but none were able to demonstrate the fact.

The writers of this paper proposed to demonstrate experimentally the existence of such an intermediate host. In the autopsies of 85 horses affected by pernicious anaemia they *always* found larvae of *Gastrophilus* on the mucous membrane of the stomach. An intravenous injection of an extract of *Gastrophilus* collected from a horse affected by pernicious anaemia caused a very rapid poisoning — followed by death in 12 minutes — of a horse; post-mortem examination showed violent haemorrhagic inflammation. The extract was perfectly harmless for other domestic animals, such as cattle, sheep, rabbits, fowls, guinea-pigs, etc., but not for the ass.

The writers showed that the larvae of *Gastrophilus* contain a hitherto unknown animal poison that they call oestrin (östrin), which is characterized by its being poisonous only for horses and asses. Injections in doses inferior to the mortal dose cause intense motor excitement of all the muscles and fever; the next day a considerable decrease of haemoglobin and of erythrocytes is observed. The activity of the extract is not diminished by high temperatures or by the presence of various chemical conditions, whence the conclusion is drawn that the hypothesis of its containing micro-organisms is to be set aside. Another fact points to this view, namely that the disease appears without a preceding period of incubation. Repeated injections of weak doses cause the animal at last to suffer persistently from pernicious anaemia, with all its characters, and then to die. The serum of the blood of horsees affected by pernicious anaemia following upon injections of extract of *Gastrophilus* larvae, when injected into healthy horses, causes perncious anaemia, which in its turn can be transmitted to other healthy horses by injection. The writers conclude that the cause of the disease is oestrin secreted by *Gastrophilus* larvae.

Not all horses which are hosts of *Gastrophilus* are affected by pernicious anaemia; but all the extracts of larvae are poisonous, even those taken from healthy animals. While the extracts of larvae of *Gastrophilus equi* are relatively of low toxicity, those of *G. haemorrhoidalis* are much more so. In horses affected by pernicious anaemia the writers almost always found *G. haemorrhoidalis*, besides *G. equi* and *G. nasalis*; while in healthy horses the former is usually absent.

The discovery of the writers affords an explanation of the following clinical observations on the natural infection:

1. The disease appears in its acute form mostly from May to October, that is during the period in which Oestrids fly about and deposit their eggs on horses.

2. The intensity of the disease varies from one year to another; the number of Oestrids also varies from year to year, probably according to the season.

3. The appearance of the disease is almost always connected with the animals being turned out to graze.

4. The disease is hardly ever propagated from diseased horses to healthy horses near them.

5. The disease never appears in horses that are regularly groomed, for instance military horses.

The disease may be treated by the expulsion of the *Gastrophilus* larvae only when it is incipient. The writers investigated whether antibodies were formed against oestrin and succeeded in obtaining a highly efficient curative and preventive serum.

Pernicious anaemia of horses may thus be controlled prophylactically by the destruction of Oestrids.

After prolonged dosing with the extract containing oestrin at first only transitory symptoms appear ; then the horses begin to be sickly and at a certain stage the disease becomes more serious, even without further injections, and leads inevitably to increasing anaemia, to high fever and then death. In this latter period the blood contains an agent that transmits the disease to healthy horses. The nature of this body cannot be determined with certainty, but judging from its behaviour to physical and chemical agents it possesses properties which differ from those of oestrin. In the first place it is unstable under the action of heat. It might be a substance that could be represented by a chemical formula and that is liberated by oestrin from certain parts of the horse's tissue and has the property of acting on the healthy tissues in the same way as oestrin itself, namely of liberating from the tissues a compound similar to itself. Thus the " ultra-visible virus " of the pernicious anaemia of the horse would be a product of anomalous metabolism formed during the course of the disease and which, transmitted to a healthy horse, sets up the pathogenic conditions which cause the same metabolic product to be formed. The process may thus be repeated indefinitely. The research work carried on at the Breslau Chemical and Physiological Institute confirms this hypothesis.

In Japan also investigations have been carried out (by SHIGA and others) into the pernicious anaemia of horses during the last five years on 980 horses and other domestic animals. They have proved that the disease is transmissible to pigs, that infection by means of faeces and urine has no practical importance, and that the appearance of the disease is connected with the presence of winged insects. By means of only *one* inoculation of *Gastrophilus* larvae it was not found possible to cause the disease. The results obtained by the Japanese commission thus agree with those of the writers.

918 – **Microphylaria in Horses affected by Haemorrhagical Boils.** — ROMANOVITCH (Veterinary Laboratory, Petrograd) in *Comptes Rendus hebdomadaires des séances de la Société de Biologie*, Vol. LXXVII, No. 26, pp. 390-391. Paris, July 24, 1914

Horses in Southern Russia are often infested by *Filaria haemorragica*. This parasite lives in the subcutaneous connective tissue and causes the formation of haemorrhagic boils on the surface of the skin ; when these break a certain amount of bleeding takes place.

On examining drops of the blood the presence of a non-sheathed microphylaria was observed ; when fixed on the object glass by the alcohol and ether mixture this measured 150 to 224 μ in length. It tapers towards its posterior extremity which ends in a longish tail.

The blood from the heamorrhagical boils contains also eggs, which enclose completely developed embryos. The shells of the eggs are very thin, and easily coloured.

In the blood taken from the jugular vein of horses affected by these boils the same microphylaria was always found.

The writer examined five horses suffering from these boils and three healthy ones from the same district. In the former he always found microphylariae, while the latter were free from them; from this he concludes that the microphylaria in question is the embryo of *Filaria haemorragica*.

919 – **Effect of Low Temperatures on the Bacilli of Anthrax. — Contribution to the Study of the Treatment of Meat Superficially Infected by Anthrax Bacilli.** POPPE, KURT (Veterinärabteilung des Kaiserlichen Gesundheitsamts) in *Zeitschrift für Fleisch- und Milchhygiene*, Year XXIV, Part 21, pp. 485-489 + 1 fig. Berlin, August 1, 1914.

The frequent appearance of localized anthrax in pigs has given a special importance to the question of judging the fitness as food of pigs thus affected, as well as of the flesh of animals that have been slaughtered together with such pigs, and which has come into contact with them.

According to the legislation at present in force in Germany pigs affected by localized anthrax are seized and declared unfit for human food, and the meat and offal that comes into direct or indirect contact with animals affected, or suspected of being affected, by localized anthrax or with their flesh, is for the most part likewise seized and declared unfit for human food or only fit under certain conditions.

In Prussia a Ministerial Order of April 12, 1913, provides that the last-mentioned meat may be exempted from seizure when upon examination it appears that no germs of anthrax have been conveyed to it. Similar legislative provisions have been adopted in most of the other German States.

The fact that the flesh of healthy pigs which becomes infected superficially at the slaughter-house is mostly treated with the same severity as diseased meats, led to investigating whether, besides the treatment with steam, low temperatures would render it harmless.

After referring to the purely scientific researches of Pictet and Young, Allan Mac Fayden and Belli (who experimented at the temperature of liquefied air) and to the more practical ones of Klepzoff, who concluded that *Bac. anthracis* may be rapidly killed by very low temperatures and in some days at higher temperatures (in 12 days at - 24° C, - 11.2° F.), the writer describes his own experiments, which consisted in keeping cultures of *Bac. authracis* in pieces of superficially infected meat, blood and organs of infected animals in ventilated cold storage at the average temeprature of - 15° C. (+ 5° F.) with average moisture of 75 to 80 per cent. The details of the experimental results are collected into tables from which the writer concludes that anthrax bacilli on meat and in cultures do not lose any of their vitality or virulence even after two weeks' storage at - 15° C. Consequently, even prolonged refrigeration does not render meat superficially infected with anthrax bacilli harmless.

920 – **Vaccination against Hog Cholera** (1). — CRAIG, R. A., and WHITING, R. A., in *Purdue University Agricultural Experiment Station, Bulletin* No. 173, Vol. XVII, pp. 441-474. Lafayette, Indiana, March 1914.

The purpose of this bulletin is to inform farmers as to the nature of hog cholera and the methods of controlling this disease. The disease exists in all sections of the United States, but is especially prevalent in the corn-raising States, where it is considered to be the disease of greatest economic importance. In Indiana alone the annual loss from this cause amounts to about $3 000 000, excluding the loss resulting from the marketing of young hogs in neighbourhoods where the disease is prevalent. In 19 years (1894 to 1912) 58 800 409 pigs were raised in Indiana, and of these 6 754 771 died of cholera.

In 1908 Drs. Dorset and Niles, of the Bureau of Animal Industry, demonstrated the method of producing an anticholera serum and its application. A number of State laboratories for the production of anti-sera were then established. For the production of a laboratory virus it is best to use young thrifty hogs weighing from 80 to 100 lbs. They should be inoculated with 2 or 3 cc. of hog-cholera blood of sufficient virulence to kill a susceptible hog in from 8 to 14 days, but preferably in 8 to 10 days. When the hog has developed fatal symptoms of disease, it is killed by cutting the carotid artery near the base of the neck. In order to increase the quantity of virus that may be secured from a hog showing fatal symptoms of hog-cholera, from 10 to 15 cc. per lb. of body-weight of a sterile physiological salt solution are injected into the peritoneal cavity of the hog two to three hours before it is bled. After the hog has bled, the solution is removed by tapping the peritoneal cavity with a side-neck cattle trocar. The lesions of hog cholera should be marked and acute in character; blood from virus hogs showing fatal symptoms of disease within 6 days following exposure and those showing lesions of septicaemia in the liver, spleen and skin, should be rejected.

The immune hogs used for the production of serum should weigh from 150 to 175 lbs., since after several re-hyperimmunizations covering a period of from 4 to 6 months the animal may double in weight and become difficult to handle. The injections should be intra-muscular or subcutaneous in the region of the thighs or shoulders. From 10 to 12 cc. of blood per lb. of body-weight are injected on two occasions with an interval of one week between them.

In the intra-peritoneal method, 10 cc. of cholera blood per lb. of body-weight are injected into the peritoneal cavity. This method is not recommended owing to the inferior serum produced.

In the intravenous method, 5 or 6 cc. of virus per lb. of body-weight are injected into the vein of the ear. The injection may be made once, or twice with an interval of one week.

The virulent salt solution recovered from the abdominal cavity of the cholera hog is about one half as virulent as the cholera blood and should

(1) See also original article by Dr. Hutyra: « Protective Inoculation against Swine Fever in Hungary ». — *B.* June 1914, pp. 707-712. (*Ed.*).

be used in double the quantity. It is advisable to inject the virus intramuscularly in the proportion of 20 cc. per lb. of body-weight.

The hyperimmunised animals are ready for bleeding in from 10 to 14 days after injection of the virus. At each bleeding, which is effected on the tail, 6 cc. of blood per lb. of body-weight may be removed, but the animals should not be bled more than three times at weekly intervals before re-hyperimmunising. This process requires only one half the quantity of cholera blood used for the first injection, and the animal should not be re-hyperimmunised the same day it is bled. It is ready for bleeding in a week or ten days after re-injection with the virus. The bleedings and injections can be practised until the tail becomes so short that it cannot be handled. The hyperimmune animal is then bled to death by cutting the blood vessels near the base of the neck, but it is advisable to re-immunise before making this final bleeding.

The hyperimmune blood is defibrinated and preserved by adding one-tenth of its volume of 5 per cent. solution of phenol. Before being used for vaccination purposes it should be carefully tested for potency and the presence of septic organisms.

The vaccination of a hog by the single method consists in giving it anti-hog-cholera serum, which confers immunity not longer than four weeks. Vaccination by the double method consists in giving an injection of anti-hog-cholera serum and one of cholera blood. The writers recommend the following doses of anti-serum: for pigs weighing from 50 to 100 lbs., one half cc. per lb. of body-weight: for pigs weighing from 100 to 300 lbs., from 50 to 90 cc. In using cholera blood: pigs weighing less than 100 lbs. receive 1 cc. and pigs weighing more than 100 lbs. 1 ½ to 2 cc.

During the period July 1908 to March 1914 the State of Indiana produced 9 881 998 cc. of serum; this was used for the vaccination of 247 049 hogs; the percentage loss in the healthy herds was 2.39, whilst that of the infected herds was 9.02.

An extract of the law relating to the prevention, spread and control of swine disease in Indiana is appended.

921 – **The Influence of Food Poor in Lime on the Composition of Growing Bones.** — WEISER, STEPHAN, in *Biochemische Zeitschrift*, Vol. 66, Part 1-2-3, pp. 95-114. Berlin, July 29, 1914. ANATOMY AND PHYSIOLOGY

The writer kept a group of three young pigs, from the 15th of January to the 1st of October, on food rich in lime and another perfectly similar group on rations poor in this substance. After the animals were slaughtered, the bones were analysed; it was found that a food poor in lime diminished the development of the animals to such an extent that from the beginning their increase in weight was about 20 per cent. less than that of the pigs fed on food rich in lime. The prolonged want of lime always caused the appetite to diminish and consequently the live-weight also.

The pigs that had not been fed enough lime had in general deformed pliable bones, thinner and easier to cut than those of the other lot. The differences in growth and weight of the skeletons, however, could not be determined. Out of the total weight of the body of the pigs poor in lime,

the weight of the fresh bones and of the dry matter represented a greater percentage (14.29 and 5.05 per cent.) than in the other lot (8.74 and 3.91 per cent. respectively).

The bones of the lot lacking lime contained considerably more water and much less ash than those of the others, but their fat content was nearly the same.

The differences in the ash content were least in the bones of the skull and greatest in the ribs. In the pigs deficient in lime, out of the total ash content of the skeleton a greater proportion was found in the skull than was the case with the other lot.

The bone-ash of the former is considerably poorer in CaO than that of the latter; a difference in the same direction, though smaller, was observed also in the $P_2 O_5$ content.

The essential difference between the composition of the bone-ash of animals deficient in lime and that of animals rich in lime is that the former includes considerable quantities of alkalies ($Na_2 O$, $K_2 O$).

FEEDS AND FEEDING

922 – **Investigations into Factors affecting the Handling of Wheat Hay, including a Study of its Digestibiiity.** — PERKINS, A. J.; PHILLIPS, J. H.; SPAFFORD, W. J., and MAY, N. S., in *The Journal of the Department of Agriculture of South Australia*, Vol. XVII, No. 7, pp. 720-755. Adelaide, 1914.

The experiments of 1912 and 1913 confirm the conclusions of 1911 (1) and include feeding trials.

King's White wheat was grown on half-acre plots which were cut at intervals of one week from the 10th of October to the 20th of November. The results are given in Tables I-V.

TABLE I.

Details of seven cuts of hay taken between full bloom and ripeness.

Date of Cutting	Yield per acre			Moisture	Loss of weight on drying	Percentage of ears by wt. in hay with 10 % moisture
	tons.	cwt.	lbs.	per cent.	per cent.	
1. — Oct. 10	1	17	86	11.31	71.33	12.26
2. — » 16	2	2	20	10.27	61.32	15.17
3. — » 23	2	9	77	10.71	53.11	19.08
4. — » 30	2	13	55	9.95	47.37	24.68
5. — Nov. 6	2	9	7	8.27	49.15	34.56
6. — » 13	2	10	93	7.53	33.63	37.09
7. — » 20	2	8	67	7.20	24.00	39.41

(1) See No. 1522, *B.* Nov. 1912. (*Ed.*)

TABLE II. -- *Composition of hay cut in various stages of maturity, in terms of oven-dried material.*

	1st Cut (Oct. 10)		4th Cut (Oct. 30)		7th Cut (Nov. 20)	
	Ears.	Culms and Hay.	Ears.	Culms and Hay.	Ears.	Culms and Hay.
Mineral matter	7.25	7.88	6.07	7.08	4.83	6.43
Organic matter	92.75	92.12	93.93	92.92	95.17	93.57
Proteins	11.86	4.56	11.16	4.38	9.71	2.28
Fat	1.16	0.64	1.10	0.94	1.10	1.10
Carbohydrates	49.66	54.38	63.06	53.90	71.34	48.12
Fibre	30.07	32.54	18.71	33.70	13.02	42.07

TABLE III. -- *Distribution of constituent parts of wheat hay cut in various stages of maturity (lbs. per acre).*

No. of Cut.	Mineral Matter	Organic Matter	Proteins	Fat	Carbohydrates	Fibre
	292.7	3 458.7	204.6	26.4	1 209.3	2 018.2
	368.5	5 026.1	326.5	51.5	1 618.4	3 029.6
	292.9	4 757.8	263.0	55.5	1 546.6	2 892.6

TABLE IV. -- *Chemical composition of wheat hay oven dried immediately after cutting and of wheat hay analysed after ordinary field drying process.*

	Oven-dried per cent.	Field-dried per cent.
Mineral matter	6.63	6.91
Organic matter	93.37	93.03
Proteins	6.13	6.13
Fat	0.80	0.76
Fibre	28.02	28.36
Carbohydrates	58.42	57.84
Moisture	58.94	11.99

TABLE V. -- *Mean coefficients of digestibility of the constituents of wheat hay cut in various stages of maturity.*

Constituents	Cut Oct. 10	Cut Oct. 30	Cut Nov. 20
Dry matter	54.32	51.82	48.83
Mineral substances	24.22	29.38	12.72
Organic matter	56.64	53.48	51.15
Proteins	60.10	53.87	60.62
Fibre	46.99	32.42	30.12
Carbohydrates and fat	61.56	62.91	59.94
Albuminoid ratio	1 : 19	1 : 15.25	1 : 12.24

Conclusions.

1. The yield of dry fodder from wheat varies according to the period of cutting; the average relative yield per cutting during the flowering period is as follows:

Days after flowering	Percentage dry fodder
6	20.31
13	24.02
21	36.04
28	32.62
35	21.90
42 (grain ripe)	14.24

The maximum yield is obtained by cutting 3 weeks after the period of full flower, when the grains leave the milky stage. This is the case with early wheat grown in a climate requiring six weeks between flowering and maturity.

2. There is a greater increase in weight in the ears than in the stem and leaves during the three weeks following the flowering period. At the end of three weeks the weight of the ear continues to increase, whilst that of the stem and leaves begins to decrease, and two weeks before maturity actually weighs less than at the flowering period. The following figures show the average (1911 and 1912) percentage increase in weight after the flowerring period.

Days after flowering	Ear	Stem and leaves
0	100.00	100.00
6	137.77	118.28
13	153.10	119.98
21	246.75	120.48
28	321.05	106.70
35	337.00	92.54
42 (grain ripe)	340.40	83.33

Cutting the crop after the grains have passed the milky stage results in a loss of nutritive substances and a badly balanced hay, and unless harvested at least two weeks before maturation the hay deteriorates considerably.

3. The relative differences in chemical composition of the crop cut at different stages are as follows: *a*) a progressive diminution in the percentage of ash and a corresponding increase in organic matter during maturation *b*) the percentages of albuminoid substances tend to increase during the first three weeks, then diminish until complete maturation of the grains; (*c*) the percentage of fatty matter appears to remain constant during the whole period; *d*) the percentage of carbohydrate in the ear increases regularly during the six weeks (being 50 per cent. of the dry matter at flowering and 72 per cent. on maturation), and it is balanced by a corresponding decrease in the stems and leaves; *e*) conversely, while the percentage of cellulose gradually increases in the stems and leaves (from 32 per cent. at flower

ng to 42 per cent. on maturation), it decreases in the ear (from 30 per ent. at flowering to 13 per cent. on maturation).

4. There is a considerable loss of dry matter in the grains during he two or three last weeks, reaching 22.9 per cent. of the highest yield n 1911 and 6.41 per cent. in 1912. This loss is undoubtedly due chiefly o the breaking of the leaves and partly to the separation of grains or ther accidents, such as a lowering or suspension of the assimilatory function, or washing out of the porous tissues by rain. The annual loss of nineral matter (20.51 per cent. in 1912-13) was considerably greater than hat of the organic matter (5.34 per cent.); from this it is concluded that migration of mineral substance towards the root takes place as maturation proceeds.

5. The loss of weight on drying decreases as the time of cutting pproaches the ripening stage. In the case of the 1st, 4th, and 7th cuts t was respectively 71.45, 47.44 and 24.04 per cent. of the green weight luring the flowering period, and less than ¼ of the green weight after naturity.

6. The percentage moisture in the hay varies slightly according to he conditions of drying. Generally hay cut early retains more moisture han hay cut late. South Australian wheat hay has an average of 10 per cent. of moisture.

7. The loss of weight of hay allowed to dry naturally in the fields s not exclusively due to the evaporation of moisture. The writers consider that at least 1.5 per cent. of this loss is due to the decomposition of organic matter, such as carbohydrates. Comparing the composition of the plant with that of the hay dried *in situ*, and assuming both to have contained the same proportions of water, the writers found a loss of 4.05 per cent. of dry weight, or 1.66 per cent. of the green weight, which they listribute as follows: protein matter 0.10, fatty matter 0.03, cellulose 0.33, carbohydrates 1.20.

Digestibility experiments on horses showed that wheat hay cut at he flowering period is more digestible than hay cut later and that the digestibility diminishes in proportion to the lateness of the cutting. There s a difference of 12 per cent, in the digestibility of hay cut at the flowering period and that cut when the grain is ripe. The decrease in digestibility s more noticeable in the case of the albuminoid and cellulose constituents and less so for the mineral matter and carbohydrates. The ratio of the digestible nitrogenous matter to the digestible non-nitrogenous matter s higher in the case of hay cut early, owing to the greater digestibility of he albuminoids in early hay and the predominance of carbohydrates n hay cut late.

Thus, there is everything to lose and nothing to gain in postponing he cutting of the crop until the grain begins to harden. The practice of judging the value of hay from its colour is fully justified, a distinct green being the best colour.

923 – **Bacteriological Research on Ensilaged Forage.** — GORINI, COSTANTINO, in *Bollettino dell'Associazione Italiana dell'industria dello zucchero e dell'alcool*, Year, VII, No. 4, pp. 83-90. Bologna, July 1914.

The bacteriological researches carried out by the writer (1) justify the suggestion, which he made in 1907, that selected lactic ferments should be added to ensilaged forage. This is all the more so as the forage from butyric silos, though it may be considered as successful, presents some disadvantages. It must especially be noted that intestinal troubles are observed in the cattle fed on such ensilage, and that this forage is to be avoided in dairies, not only for the odours and flavours which it may impart to milk and butter, and especially to the bacterial flora, of a gas-forming nature, which may cause cheese made with such milk to swell.

924 – **Live Stock Feeding Experiments in Ireland, 1912-13.** — *Department of Agriculture and Technical Instruction for Ireland, Journal*, Vol. XIV, No. 3, pp. 456-470. Dublin, April 1914.

These experiments are in continuation of those begun in 1912. (*Journal*, Vol. XIII, No. 3).

1. — Pig Feeding Experiments.

Series I. *Comparison of potatoes and meal.*

The object of these experiments was to determine if pigs can be fattened successfully without potatoes. During the past two seasons the experiment was conducted with 148 pigs at 20 centres distributed throughout 13 counties. The average age of the pigs was 13 ½ weeks and the duration of the experiment 108 days. At each centre the pigs were divided into two lots. Lot 1 received a certain quantity of potatoes in addition to other foods (maize, pollard and separated milk), whilst lot 2 was given an extra pound of the meal mixture in place of every 4 lbs. of potatoes fed to lot 1.

The results obtained are set forth in Table I.

Whilst these figures show that the average daily gain in live-weight was practically the same for each lot of pigs, nevertheless, in respect to rate of increase in live-weight, cost of producing a given increase in live-weight and quality of pork, the pigs fed on meal alone were slightly, but fairly uniformly, superior to the pigs which received potatoes. The question as to whether potatoes should be sold or fed to pigs depends largely upon the current prices of potatoes and meal respectively. It is very doubtful whether it is economical to feed pigs on saleable potatoes if they can be sold for one-fourth the value of meal, in addition to the cost of marketing.

Series II. *Barley meal compared with maize meal.*

This experiment was conducted with 106 pigs at 15 centres. The average age of the pigs at the commencement was 13 weeks and the duration of the experiment 100 days.

The results obtained are set forth in Table II.

(1) See No. 541, *B.* June 1914. (*Ed.*)

TABLE I.

Food.	Price per cwt.	Quantities. Lot 1.	Quantities. Lot 2.
	s. d.	cwt. lbs.	cwt. lbs.
Maize meal	7 6	141 21	220 92
Pollard	7 0	89 101	146 26
Oat meal	12 0	0 84	0 84
Potatoes	2 0	524 28	— —
Separated milk	1d. per gallon.	3247 gallons	3 247 gallons
Linseed cake	10 6	2 28	2 28
Table refuse.	— —	— —	— —
Total cost of food	— —	£155 10 s.	£149 13s.
Average increase in live-weight	— —	1 cwt. 50 lbs	1 cwt 54 lbs
Cost of producing 1 cwt. live-weight increase	— —	£1 9s 1d.	£1 7 3d.

TABLE II.

Food.	Price per cwt.	Quantities. Lot 1.	Quantities. Lot 2.
	s. d.	cwt. lbs.	cwt. lbs.
Barley meal	7 0	134 99	— —
Maize meal	7 6	—	135 23
Potatoes	2 0	339 9	335 65
Swedes	8s per ton	35 0	35 0
Separated milk	1d per gallon	1 062 gallons	1 051 gallons
Linseed cake	10 6	2 0	2 0
Table refuse	— —	— —	— —
Cost of food	— —	£87 15s 10d	£90 17s 8d
Average live-weight increase	— —	1 cwt. 34 lbs.	1 cwt. 37 lbs.
Cost of producing 1 cwt. live-weight increase	— —	£1 5s 6d	£1 5s 10d

In two experiments where swedes were fed instead of potatoes, the pigs made very slow progress, the average daily increase scarcely exceeding one pound per head. The results of these experiments appear to indicate that maize is worth approximately 10s per ton more than barley meal for pig feeding. As regards quality of pork, barley meal seems to be slightly superior to maize meal. It should be noted that the estimated

cost of production is based on the cost of the food only . In practice, many other items, such as attendance, fuel, risk and interest on capital have to be considered.

2. — Calf Feeding Experiment.

This experiment was designed to compare the value of oat meal and wheat meal respectively, when used in conjunction with maize meal and ground linseed for calf feeding. It has been carried out during the past two seasons at 31 centres. 244 calves were selected and divided into two lots ; their average age at the commencement was seven weeks and the experiment lasted 117 days.

The results are given in Table III.

TABLE III.

Food.	Price per cwt.	Quantities.	
		Lot 1.	Lot 2.
	s. *d.*	cwt. lbs.	cwt. lbs.
Oat meal mixture	14 0	105 92	— —
Wheat meal mixture	13 0	— —	105 83
Linseed cake	10 6	31 72	31 72
Whole milk	5 *d.* per gallon	91 gallons	91 gallons.
Separated milk	1 *d.* per gallon	18 765 gallons	18 765 gallons
Total cost of food	—	£170 15*s* 5*d*	£16 5*s* 8*d*
Live-weight increase (mean)	—	1 cwt. 78 lbs.	1 cwt. 77 lbs.
Cost of production of 1 cwt. of increase	—	16*s* 6*d*	16*s* 1*d*

In the above estimates no account is taken of the value of the hay consumed or the grazing, but these items are the same for both lots. On the whole, there was no appreciable difference in the health or appearance of the two lots of calves. The difference in the cost of production is so small that it would appear that the two meal mixtures are of practically equal value at the prices mentioned.

III. — Cattle Feeding Experiments.

Experiment A. — Cattle on grass.

This experiment has been conducted at 14 centres with two lots of 62 cattle each. Lot 1 received a mixture of home-grown concentrated foods, whilst lot 2 received a corresponding quantity of imported foods.

The mixture were made up as follows :

Home-grown.	*Imported.*
1 part wheat meal.	1 part maize meal.
1 ½ parts barley meal.	2 parts undecorticated cotton cake.
2 parts ground oats.	

At the beginning of the experiment 3 lbs. of the above mixtures were given per head daily; this amount was afterwards increased to 4 and finally to 5 lbs. towards the end of the fattening period. The average duration of the experiment was 79 days.

The results are set forth in Table IV.

TABLE IV.

Food.	Price per cwt.	Quantities. Lot 1.	Lot 2.
	s. d.	cwt. lbs.	cwt. lbs.
Home-grown:			
Wheat meal	8 0	43 60	— —
Barley meal	7 0	65 34	— —
Ground oats	6 8	87 8	— —
Imported:			
Maize meal	7 6	— —	65 34
Undecorticated cotton cake	6 6	— —	130 68
		£ s d	£ s d
Cost of food:			
Concentrated	— —	69 5 10	66 18 9
Grazing	— —	69 19	69 19 5
Total	— —	139 8 3	136 18 2
Manurial value	— —	7 3 7	13 2 3
Total cost of food less manurial value	— —	132 1 8	123 15 11
Total increase of live-weight	— —	117 cwt. 102 lbs.	117 cwt. 102 lbs.
Cost of producing one cwt. live-weight increase	— —	£1 2s 5d	£1 1s 5d

The average results of these experiments show that the increase in live-weight made by the two lots of cattle was identical, but the cost of production was somewhat in favour of the imported foods.

Experiment B. — Stall-fed cattle.

This experiment was carried out at 21 centres with 176 cattle in 2 lots. Lot 1 received the same home-grown foods as in the preceding experiment, whilst lot 2 received a mixture of 1 part decorticated cotton cake and 2 parts maize meal. At 15 centres, part of the decorticated cotton cake was replaced by linseed cake during the finishing period.

At the beginning of the experiment 3 lbs. of concentrated food were given daily, and this quantity was gradually increased, until in some cases as much as 10 lbs. were supplied. The average duration of the experiment was 82 days.

The results are set forth in Table V.

TABLE V.

Food.	Price pee cwt.	Quantities.	
		Lot 1.	Lot 2.
	s. d.	cwt. lbs.	cwt. lbs.
Home grown:			
Wheat meal	8 0	90 54	— —
Barley meal	7 0	135 81	— —
Ground oats	6 8	180 108	— —
Imported:			
Maize meal	7 6	— —	271 50
Decorticated cotton cake	9 6	— —	144 25
Linseed cake	10 6	— —	21 56
Bulky food:	per ton.	tons. cwts. qrs.	tons. cwts. qrs.
Roots	8 0	256 1 3	256 1 8
Hay	40 0	26 5 2	26 5 2
Straw	30 0	14 8 3	14 8 3
Cost of food.		£ s d	£ s d
Concentrated	— —	144 0 5	167 6 6
Bulky foods	— —	176 12 9	176 12 9
Total	— —	320 13 2	343 19 3
Value of manure produced	— —	14 18 1	26 12 0
Cost of food less manurial value	— —	305 15 1	317 7 3
Total live-weight increase	— —	112 cwt. 40 lbs	118 cwt. 72 lbs.
Cost of producing 1 cwt. of live-weight increase.	— —	£ 2 14*s* 5*d*	£ 2 13*s* 6*d*

The average live-weight increase was one-tenth pound per head daily in favour of the imported foods, and the cost of production per cwt. live-weight increase was 11*d* in favour of the imported foods.

Considered as a whole these experiments show that for all practical purposes no superiority can be claimed for either class of concentrated foods at the prices quoted.

BREEDING

925 – **Preliminary Notes on the Heredity of Certain Characters in a Cross between Silky and Yokohama Fowls.** — BONHOTE, J. L., in *The Cairo Scientific Journal*, Vol. VIII, No. 91, pp. 83-89. Alexandria, April 1914.

The writer received from M. Debruil, of Melu , Fra ce, a pair of fowls which were the offspri g of a male Silky a d a female Duckwing Yokohama; the cross had bee made i the hope of obtai i g birds combi i g the texture of feathers of th Silky with the length of feathers of the Yokohoma, with a view to using the feathers as substitutes for

"ospreys", etc., the writer bred from these two birds to study the inheritance of the characters involved.

The characters of the parent birds were: *Silky* (male), dark-fleshed, white, with short silky feathers, rose comb, five-toed, with feathered legs and a small crest; *Yokohama* (female), white-fleshed, Duckwing, with long normal feathers, a single comb, four-toed, clean legs and no crest.

The two birds of the F_1 generation were uniform (sex excepted) and showed a practically complete dominance in almost all cases, *e. i.* dark fleshed, coloured plumage ("black-red"), normal feathering, long-tailed (especially in the male), clean legs, crested. The carriage of the tail-feathers was intermediate between that of the parents. The male had five toes and the hen only four.

The F_2 generation is considered in two groups. The first group, consisting of 96 individuals, deals only with those characters such as colour of flesh and feathers, simple or rose comb, 4 or 5 toes, which are visible at birth and on which statistics concerning all the chickens hatched are available. Of these 66 pigmented flesh and 30 non-pigmented; 71 were coloured and 25 white, (expectation 72:24) but very few were pure white; the majority showed some red pigmented feathers on the saddle, the coloured portions being sharply divided from the rest. It is evident that these chickens are not pure recessives but contain a certain amount of pigment. 30 chickens hatched from eggs of these individuals showed the same characters, giving no really coloured ones. The writer suggests that this form of coloration is the initial stage of the "pile" type of coloration found in other breeds of fowls.

No "Duckwing" character appeared in the F_2 generation, all the individuals being of the "black-red" type, but of two kinds, one having black breasts with a few red feathers, the other red breasts with a few black feathers.

With regard to character of comb, 83 had rose combs and 13 single combs. The ratio of five-toed individuals to four-toed was 64 : 32. The inheritance of both these characters was complicated by intermediate forms.

The characters of the second group, *viz.* silky or normal feathering, long or short feathers, clean or feather legged, crested or not, were studied in 24 individuals reared to maturity. Of these 18 were normal and 6 silky. The flight feathers and tail feathers are only silky at their ends and practically normal at their bases. The length of feathering is difficult to determine and apparently not inherited in a strictly Mendelian manner. No two birds were alike in this respect, but the writer by adopting a provisional standard, divided the birds when six months old into two groups of 19 long and 5 short, thus showing that the long-feathered type is dominant. The real character which determines the length of the feather is the growing period of the feather follicle and this is undoubtedly influenced by the food, environment and individual vigour of each bird, so that when this character is blended with the normal it is only to be expected that the actual length of feather in the progeny would be largely dependent on the indi-

vidual when the environment remains constant. Sixteen individuals were clean-legged and 8 feathered, but, of the 8 feathered ones, 4 were only half feathered and therefore almost certainly heterozygous, thus giving 20 dominants and 4 recessives. The crest was developed in these crosses, being present in 21 individuals and absent in only 3.

Thus, the Mendelian expectations with regard to each character have been largely realised. The writer remarks that recessives are more frequent among females, owing to the absorption of more of their mitial vigour, on their sex, and that recessive characters more usually associated with the female can be produced in males by an artificial reduction of vigour. Also if colour may be to a certain extent an indication of vigour, we shall expect to find a higher percentage of recessive characters among white birds than among the coloured ones.

Of these 24 birds, 10 were males and 14 females, 19 coloured and 5 white.

The 10 males showed 13 recessive, 6 heterozygous and 61 dominant characters ; the 14 females showed 24 recessive, 14 heterozygous and 42 dominant characters. The 19 coloured individuals showed (xcludi g the white or coloured as characters) 22 recessive, 14 heterozygous and 133 dominant characters ; the 5 white individuals showed 10 recessive. 6 heterozygous and 19 dominant.

These results show that on the average the females have 0.41 more recessive characters than the males, and the whites 0.74 more recessive characters than the coloured.

The writer therefore concludes that the Mendelian proportions are to a certain extent affected by vigour and that it is practically possible to increase the number of individuals possessing a certain character by attention to such details as the food, temperature, age of the breeding stock and time of year at which breeding takes place.

926 – **Studies on Inheritance in Pigeons: Hereditary Relations of the Principal Colours.** — Cole, L. J., in *Agricultural Experiment Station of the Rhode Island State College, Bulletin* No. 158, pp. 313-380 + 4 plates. Kingston, R. I., May 1914.

These investigations were begun at the Rhode Island Agricultural Experiment Station in 1907, to determine the mode of inheritance of coat colour in birds. Previous work on inheritance in birds (fowls and canaries) has not given data as definite as in the case of mammals. In the case of fowls this was undoubtedly due to the complications introduced by coloured patterns originating in different colour schemes for each feather. Pigeons have been chosen because it is possible to select strains of uniform colour and free from pattern complications.

In most of the studies with fowls, crosses were made with very different breeds showing very marked differences in a large number of characters thus resulting in confusion. The writer has considered it more advisable to confine his observations to certain well-defined differences in the same breed (Tumblers). It also appeared less probable that similar characters would behave differently in the same breed.

The primary colours of pigeons are : red, yellow, black, brown, blue, silver, and white. These experiments have shown that these colours are produced by only two types of pigment, black and red. Red is the fundamental colour of pigeons and probably also of fowls and the majority of mammals. The red factor is always present, but it only determines the colour of the bird in the absence of an inhibiting factor or of a dominant factor such as the factor for black. For the full manifestation of these two colours an intensifying factor is necessary. When this factor (I) is absent, the colour is of a lighter shade and red becomes yellow, whilst black becomes dun. The I factor is definitely sex-linked in its inheritance. "Duns" are easily obtained by crossing birds having the B factor with birds lacking the I factor, *e.g.* black × yellow.

Thus, mating a yellow cock (bbii) with a black hen (BBIi) heterozygous for I, will produce black cocks and dun hens, since the factor I is limited to the males. In the reciprocal cross all the F_1 generation will be black and duns will appear in the F_2 generation.

The blue colour of the wild pigeon (*Columba livia*) is due to the optical effect of black pigment aggregated into clumps. In the black birds the pigment is uniformly distributed. This is accounted for by supposing the presence of a spreading factor (S), the absence of which results in the blue colour. Silver colour is regarded as a diluted blue and is therefore black minus the factors I and s. White is due to the absence of pigment and the reflection of light. Pure whites are fairly common but rarely breed true, and the mode of inheritance is very complex. Colour is dominant over white but not entirely. Pure white should undoubtedly be considered as the extreme reduction of mottling. As a provisional hypothesis white may be considered as due to the presence of an indefinite number of factors preventing the formation of pigment. Thus the quantity of white depends on the number of these factors present.

The marking of the plumage of pigeons may be of the following types: 1) splashes or intermingling of white and coloured feathers without definite patterns; 2) special patterns, *i. e.* a combination of white and coloured areas forming a more or less definite marking ; 3) check, light triangular markings on the wings ; 4) grizzling, *i. e.* barbs partially white and partially coloured ; 5) mealiness, due to the whole or partial replacement of white by red ; 6) frosting, due to the presence of white distal margins on the contour feathers.

It is possible that a particular portion of the plumage may be represented by homozygous factors, such as W_1, W_2, etc.

The frequent reappearance of the blue colour of the wild rock pigeon (*Columba livia*) is due to the recurrence of the particular combination of factors present in this type.

In the experiments on the dominance of black over red, the F_2 ratio was nearer 2:1 than 3:1. This was not due to the absence of homozygous dominants, but rather to the tendency toward the production of different ratios in different families or strains. All the results show a slight excess

of red offspring above the normal expectation of a pure dominant and recessive.

In the experiment on the inheritance of the I factor the crossing of heterozygous individuals always gave the 3 : 1 ratio ; the cross between the heterozygous F_1 and the recessive parent always gave the ratio 1:1, thus showing that the factor for intensification of colour segregates in a strictly Mendelian fashion.

Various matings between birds of different colours gave results according to expectation. In general the offspring tend to be grouped around the parental mean with respect to amount of colour in the plumage. The evidence points to the conclusion that a number of factors are concerned in the production of white and splashed birds.

STOCK RAISING : ORGANIZATION AND ENCOURAGEMENT

927 – **Animal Husbandry in Sardinia in Connection with Environment.** — DORIA, MARIO, (Director of the Royal Horse-Breeding Station of Ploaghe) in *Il moderno Zooiatra*, Series V, Year III, No. 7, pp. 313-326. Bologna, July 31, 1914.

In Sardinia, where agriculture is still mostly extensive, live stock is the most important source of income. The animals are generally bred wholly in the open.

Horses. — The Sardinian horse, descended from African and Asiatic breeds, has had a period of celebrity, which came to an end chiefly through too close in-breeding. According to the writer, when the State founded the stallion depots and stations, a great mistake was made in not taking the native horse into account, and of using among others English stallions ; these increased the stature of the animals but at the expense of their muscle and the harmony of their shape. The cross of the Sardinian (Oriental) with the English horse has led to a great variation of forms, so that no uniform local breed exists. The horses of Gallura and of Anglona have most English blood, and form a distinct type. According to the writer the stallions to be adopted for the improvement of Sardinian horses should be of pure Oriental breeds, which, like the native Oriental crosses, have the advantage also of being better stock getters than the English stallions.

Cattle. — Cattle breeding has made much progress of late years in Sardinia. There are three breeds of cattle in the island : the plain breed, imported from Sicily, the Schwytz (brown variety) on the hills and in the best pasture lands ; the Sardinian or mountain breed, which has remained in its primitive state, not having been subjected to any crossing. It inhabits the mountains especially of Gallura, of the Fonni plateau and of Fonni, Orgosolo and Aritzo. The plain breed lives in the so-called *planargia* and the Campidano towards Oristano ; it is especially suitable as a draught animal ; the meat is good, but not much sought after on the markets. The small mountain breed is a good draught animal for rough and stony localities ; it does not yield much milk; its flesh is excellent, though but little streaked with fat. The Schwytz breed has given origin to the Swiss-Sardinian breed, which is raised all over the island and gives excellent products, as for instance at Oristano, Macomer, Ozieri, Nulvi, Ploaghe, Mores, Bonorva, etc. The Schwytz breed has proved the best for the improvement of Sardinian cattle, though the excess of new blood, if not accompanied by improve-

ments in the pastures and in the treatment, sometimes causes stunted development and a decrease in the yield of meat and milk. For this reason the writer deprecates the use of a pure-bred bull beyond the third or fourth generation, after which cross-bred bulls should be used unless special reasons suggest recourse to a pure bull again.

Sheep. — Grazing is the most important industry in Sardinia. There are two breeds in the island, one in the plains and the other in the mountains. On the plateau of Bitti and in the districts of Fonni, Orgosolo, etc., there is a small hardy breed with roughish and short wool, which does not yield much milk ; it passes the winter in the plains or on the hills. In the hills and in the richest pastures the sheep are a cross derived from the mountain breed and the Campidano breed, which is only an importation from Algeria, Tunis and the plains of Apulia. It is bred pure in the fine plains of the Campidano of Oristano. The introduction of a certain amount of the blood of this breed into the mountain breed produces sheep of a suitable stature, yielding good wool and flesh and a fair quantity of milk (an average of 1 ½ to 2 pints per day in spring and in favourable winters). Further crossing gives a much larger sheep which yields more meat but at the expense of the yield in milk and wool. It would therefore be advantageous to practice alternate crossing, that is using Campidano or Apulian rams for two or three generations and then cross-bred rams.

Pigs. — Pig breeding is also flourishing in Sardinia ; it is chiefly a small industry of the poor, but there are also extensive herds on the mountainous and wooded parts of the island. The principal pig-breeding centres are Bono, Bolotana, Silanus, Monti, Buddusò and the Gallura region, which is also mountainous and rich in woods. Pig breeding is practised more or less all over the island. In the chief centres the local breed has been crossed with the Caserta, the Verona and Yorkshire crossbreds. Such pigs are frequently met with in the cuntry about Ozieri, Mores, Pattada, Nulvi and Ploaghe. The Sardinian breed still bears a considerable resemblance in build to the wild boar ; crossing it with other breeds has much improved its flesh, increased its weight and caused measles to disappear from many herds. The crosses at the age of two years weigh 440 to 550 lbs. dead weight ; the pork and hams are excellent. The pigs are fed on buttermilk, whey and bran up to the age of five or six months, after which they are tied up in sties to be fattened. Sometimes the want of exercise and cleanliness causes a form of rheumatic arthritis, on the appearance of which the animals have to be slaughtered immediately.

928 — **Report of the Dickinson County Cow-Testing Association : Results of the First Year** — REED, O. E., in *Kansas State Agricultural College Experiment Station, Circular* No. 35, 8 pp. Topeka, Kansas, 1914. CATTLE

The records of the Association contain a complete account of the performances of 134 cows during a period of 12 months. The average annual production of these cows was 6019 lbs. of milk and 246 lbs. of butter-fat, while the average Kansas cow produces only 100 lbs. of butter-fat. The average cost of feed was $ 35.59 per cow per annum and the value of the butter-fat produced was $ 90.48, leaving a net profit per cow of $ 54.89,

assuming that the calf and manure produced are liberal compensation for the labour and risk.

The best cow (a Holstein) produced 546 lbs. of butter-fat in 11 months ; the poorest cow in the same herd produced only 175 lbs. of fat, whilst the poorest cow in the Association produced only 59 lbs. at a cost of $ 33.23. The ten best cows made an average rofit of $ 96.43, which is more than six times the average profit made by the ten poorest. With one exception, the ten best cows were dairy-bred animals, while there was only one of the ten poorest that showed any trace of dairy blood in its pedigree. The ten poorest cows made an average of only 119 lbs. of butter-fat for the year, at a profit of $ 15.23. The profitableness of these poor cows appears still less when one considers that most of them calved in the spring and produced milk only while on grass, thus greatly cheapening their rations. Further, the value of the calves and manure from this batch of cows would not fully compensate for the labour expended, while in the case of the ten best cows it would be an additional source of profit.

Some of the cows with low records of milk production were handicapped by being allowed to remain dry several months of the year and are capable of much better performances under better conditions. It is generally true that many good milch cows are allowed to go dry longer than is necessary and it should be borne in mind that a cow returns the greatest profit when kept in milk throughout the greater part of the year.

SHEEP

929 – **The Breeding of Karakul Sheep in the United States** (1). — YOUNG, C. C., in *The Journal of Heredity*, Vol. V, No. 4, pp. 170-178 + 3 figs. Washington, April 1914.

The first importation of Karakul sheep into the United States was made in 1909, when the writer brought 10 ewes and 5 rams from Bokhara to Wichita Falls, Texas. In 1913 a second batch of 17 was received from Central Asia. Of the first importation only two gave birth to lamb which had thick curly fleeces. The writer found that among the imported sheep and rams, some had thick coarse fibres in their fleeces whilst others had a layer of short fine, reddish wool under the fleece, which was without gloss and resembled Merino wool under the microscope. The animals imported from Bokhara gave lambs with thick curly fleeces, whilst the lambs belonging to the second importation had open fleeces worth little more than fur. The writer is of opinion that the fineness of the wool of the latter group of sheep is due to admixture with some Afghan breed possessing fine wool, and he proposes to call them the Afghan Karakul breed. It is easy to eliminate the fine wool characters in one or two generations by using a ram entirely free from fine wool.

Crosses between Karakul rams and Merino and Shropshire ewes do not produce good fleeces, but good results were obtained with Lincoln Longwool crosses and with red fat-tailed Persian sheep (*Ovis steatopygia*). which are free from short wool. The Persian sheep only produces curly-wooled lambs when crossed with the Astrakhan breeds and its wool is wrongly classed as fur in commerce.

(1) See also No. 282 *B.* March 1913 ; No. 653 *B.* July 1914. (*Ed.*).

There are six classes of sheep in Central Asia called Karakul by the Russians, and Arabi by the inhabitants of Bokhara, and they all derive the black pigmentation, the tendency to close curly wool and their glossy fleeces, from the small black Danadar sheep, now almost extinct.

These are: 1) the Large Arabi or Duzbai sheep; 2) Small Arabi; 3) Medium Arabi, a hybrid between 1 and 2; 4) Grey Shiraz; 5) Zigois (these five classes are not very numerous); 6) Afghan Karakuls, which unfortunately constitute 90 per cent. of the fur classes of Bokhara, since, though they are hardy and produce excellent flesh like the other races, they only yield a fur of inferior quality unless crossed with rams of the other breeds. The small Arabi is the best breed and the Duzbai is quite satisfactory and makes a good cross with our common sheep, increasing the weight and improving the quality of the flesh. The writer is of opinion that the Afghan sheep is the ancestral form of the Merino.

Sheep imported from Bokhara, besides being seldom free from fine wool, are too often inbred, since they come from small districts in the neighbourhood of railway stations (Tjardjui, Kara-Kul, Bokhara). The Karakul sheep imported into Russia, Germany and Austria are of very small value.

GOATS

930 – **The Age of Goats according to their Teeth.** — SCHEUNPFLUG, in *Berliner Tierärztliche Wochenschrift*, Year 30, No. 28, pp. 503-504. Berlin, July 9, 1914.

Most of the data at present available on the age of goats according to their teeth present considerable discrepancy and do not correspond to actual facts, for, as the present investigation proves, the appearance and the replacing of the teeth takes place generally earlier than the above data state.

According to the observations of Dr. Scheunpflug the central incisors are replaced at 14 to 16 months; goats which have their central permanent incisors up are, as a rule, upwards of one year old and seldom upwards of 23 months.

The 2nd pair of incisors change in general at 19 to 22 months. Goats that have their 2nd pair of permanent incisors up are above 17 months old and but rarely over 34 months.

The 3rd pair are replaced mostly at 21 to 26 months and generally between 23 and 24 months. After the 3rd pair of permanent incisors are up the animals are, as a rule, above 19 and under 36 months old. Exceptionally however they may be older.

The corner incisors are generally replaced at between 29 and 38 months, most frequently between 32 and 36 months and in some cases even later than 38 months. Goats with the corner permanent incisors up are mostly upwards of 28 months old. (In judging the age by the jaws of dead animals the appearance of the third molars has also to be taken into consideration, as well as when only the first three pairs of permanent incisors are up).

In most cases the permanent teeth are all up at 2 $^3/_4$ to 3 years.

In practice, in judging the age of goats by their incisors it may be assumed that in general the central pair are replaced at the age of 1 $^1/_4$

years, the 2nd pair at 1 $^{3}/_{4}$, the 3rd pair at 2 and the corner pair between 2 $^{3}/_{4}$ and 3 years. Thus the intervals between the replacement of each pair of incisors are about 6 months, about 3 months, and 9 months (more precisely from 6 to 12 months) respectively.

It sometimes happens that the two permanent incisors of a pair do not appear at the same time; if only one is up, the age, should be reckoned a month less than if both are up.

The lack of permanent incisors, especially of the central pair, is in most cases due to oligodonty, which in some localities has been frequently observed.

In determining the age by the jaws of dead animals valuable data are furnished by the molars also, all the more so as the periods of their appearance and replacement in goats have a more restricted range than is the case with the incisors.

According to Dr. Scheunpflug the appearance of the molars in the lower jaw generally precedes that in the upper jaw. At the age of 3 months the first molar appears in the lower jaw and at 4 months the corresponding tooth in the upper jaw.

At the age of 5 ½ months the first upper and lower molars are in wear. In some cases the second molars pierce through the gums in the lower jaw shortly before the eighth month, as a rule however, between 8 and 9 months, seldom later. In the upper jaw they appear between 8 and 10 months.

At 12 months the second molars are in wear. The change of the premolars takes place at from 17 to 20 months and at the same time in the upper and lower jaws. Sometimes one temporary molar is cut first, sometimes the other, as the replacing depends only upon accessory circumstances.

After the replacing of the above temporary molars, in general after these are in wear, the third molars are cut. They appear between 18 and 21 months, apparently a little later in the upper jaw than in the lower one.

All the third molars are up at between 18 and 24 months, and in wear not before 26 months. At the cutting of the third molars, it must be noted, in general the 2nd and sometimes the 3rd pair of incisors are replaced.

Oligodonty of the molars was observed by the writer only in the 3rd pair.

The data found in the literature on the replacing of the teeth in sheep are compared with the writer's observations on goats. It appears that the termination of the period during which the incisors are replaced is nearly the same in goats as in early-maturing sheep (especially according to the data of Cornevin and Lesbre). There is nevertheless a small difference in that the period between the replacing of the first and second pairs of incisors in sheep is about two months shorter than in goats. On the other hand the interval between the 2nd and 3rd pairs is shorter in goats.

The temporary molars are certainly replaced earlier in goats than in sheep, as, according to the writer, the premolars are replaced in goats

shortly before the cutting of the third molar, while in sheep this happens only after the cutting of the latter or at the same time.

931 – **The Rearing of Reindeer in Alaska** (1). — CHUBBUCK, LEVI (Office of Farm Management, Bureau of Plant Industry, U. S. Department of Agriculture), in *The Journal of Heredity*, Vol. V, No. 4, pp. 149-154 + 3 figs. Washington, April 1914. REINDEER

The introduction of the European reindeer into Alaska was recommended by Prof. S. F. Baird in 1851, notwithstanding the fact that the indigenous American caribou is capable of domestication. This suggestion was also made by Townsend in 1867, and in 1892 Dr. Sheldon Jackson, agent-general of the Bureau of Education in Alaska, introduced a small herd of domesticated European reindeer, which was followed by others. As a result of breeding, their number now reaches 40 000 and has transformed the native people from hunters and fishermen to herdsmen.

The reindeer indigenous to North America are: *Rangifer arcticus* (Barren-ground Caribou), inhabiting the extreme north, and *R. caribou* (Woodland Caribou) in the wooded region south of the former. This latter species differs slightly from that of the old world (*R. tarandus*). Apparently no attempt has been made to domesticate it, though it is fertile when crossed with the domestic reindeer; this character is valuable, since the native species are larger and stronger than the imported species which appears to show signs of degeneration. The present area of undeveloped land in Alaska that would be suitable for rearing reindeer is estimated at 100 000 square miles, capable of supporting 10 million deer. The most suitable region is north of the Yukon river. The reindeer lichen (*Cladonia rangiferina*) occurs throughout the arctic region of Alaska, in the Seward peninsula, in the tundras of the west and in the mountains of the Alaska chain and of the Alaska peninsula.

Reindeer do not require shelter; in fact they require no care beyond watching. Almost half of the present herds are in the Seward peninsula and the remainder are distributed as far as Point Barrow on the Arctic Ocean in the Alaska peninsula and to Tanana towards the Yukon river. They belong to Eskimos, Indians and a few Laplanders; the latter were brought over with the animals by missionaries to teach the care of the reindeer. Some herds belong to the Government. The Alaska Division of the U. S. Bureau of Education, Department of the Interior, looks after all the herds, through the masters of the Government native schools.

In 1911 a hundred carcasses were sent from Norne to Seattle and sold for 75 cts. per lb. Up to the present the Alaska markets have consumed all the reindeer flesh which is produced. A dressed carcass averages about 130 lbs. in weight; the butcher buys the dressed carcasses at about 25 cents per lb. The most suitable age for slaughtering the animals is 7 or 8 years, *i. e.* after they have been worked for 5 or 6 years. The cows are rarely milked in Alaska; any milk obtained is consumed fresh after dilution with water or as cheese; butter is never made, since the fat has a rancid flavour. There is a heavy loss amongst the young animals ow-

(1) See also No. 1186, *B.* Oct. 1913 (Reindeer in Newfoundland). (*Ed*).

ing to the unscientific method of rearing introduced by the Laplanders and the tundra fires, so that the rate of increase of the reindeer is only half that of herds of cattle.

POULTRY

932 – **Winter Egg Records in Ireland.** — *Department of Agriculture and Technical Instruction for Ireland, Journal*, Vol. XIV, No. 3, pp. 546-547. Dublin, April 1914.

The data presented are from records kept in Ireland under the control of the Department.

TABLE I. — *Average number of eggs per hen during the six months October to March.*

Breed.	1908-09	1909-10	1910-11	1911-12	1912-13	1913-14
White Leghorn	44.3	39 7	41 5	45.1	42.4	47.4
Brown Leghorn	40.7	42.1	37.9	49.3	51.8	38.1
Black Leghorn	—	—	—	—	64.3	—
Minorca	32.8	38.0	48.3	48.3	86.3	60.5
Buff Orpington	54.5	42.4	45 2	42.6	49.1	58.6
White Orpington	50.7	48 7	54 1	52.6	44.1	38.6
White Wyandotte	56.6	34.2	45.2	45.8	42.9	33.9
Faverolle	42.5	41.5	35.7	28.8	42.2	34.9
Plymouth Rock	35.9	39.2	45 5	36.5	43.1	38.8
Ancona	—	—	—	64.9	—	—
Houdan	59.2	58.5	62.5	58.0	75.8	46.4
Andalusian	—	71.3	—	—	—	—
Rhode-Island Red	—	—	63.9	61.9	49.1	48.4
Light Sussex	31.6	32.1	39.8	41.8	38.4	49.7
Red Sussex					—	32.5
Mixed pure breeds	39.7	—	—	—	—	—
Mixed breeds	40 8	41.9	40 5	41.6	43 7	42.4
Average	42 3	40.7	42.7	41.8	44.2	42.2

TABLE II. — *Variations in different strains of the same breed.*

Breeds	Average of all flocks	Average of the best flock	Average of the worst flock
White Leghorn	47.4	75.0	31.5
White Wyandotte	33.9	53.3	22.0
Faverolle	34.9	57.8	21.2
Plymouth Rock	38.8	60.8	20.9
Rhode-Island Red	48.4	59.1	28 7
Light Sussex	49.7	72.4	38.3
Mixed breds	42.4	78.6	16.9

Omitting the breeds of which the returns relate to less than 100 birds, the following is the order : Light Sussex, Rhode Island Red, White Leghorn, Plymouth Rock, Faverolle, White Wyandotte.

The egg-laying capacity of the different strains of the same breeds varies considerably, as shown in Table II.

933 – **Attempts at Breeding the Great White Heron and the Buff-Backed Heron (Cattle Egret) in Madagascar.** — GUILHELM, in *Colonie de Madagascar et Dépendances, Bulletin Économique,* Year 13, No. 4, pp. 472-476. Antananarivo, 1913.

With a view to protecting the great white heron and the buff-backed heron in Madagascar, an Order was issued on May 3, 1913, forbidding their being shot in the island. These two species are valuable for their plumage and the second is a very useful bird, as it feeds almost exclusively upon cattle ticks, which often spread contagious diseases. The writer, having observed that the Malagasy kept birds caught young in a state of perfect domesticity, thought of the possibility of breeding them economically. He tried keeping them in cages and fed them with raw meat and fish. His attempts have been successful, and the cutting of the feathers has been found more advantageous than plucking them.. M. Guilhelm thinks that breeding these birds would be especially suitable in the northern and north-eastern provinces of Madagascar.

934 – **New Research on the Visual Power of Bees.** — VON HESS, in *Die Naturwissenschaften,* Year 2, Part 34-35, pp. 836-838. Berlin, August 28, 1914. BEES

The writer reports upon a series of experiments, all of which agree in proving that it is quite out of the question to think that bees have a sense of colour in any way comparable with that possessed by man.

935 - **Apiculture in Ireland.** — *Daily Consular and Trade Reports,* Year 17, No. 167, p. 342. Washington, July 18, 1914.

The importance of apiculture in Ireland may be judged from the following statistics of production :

	Average 1901-1910	1911
	lbs.	lbs.
In hives with removable combs:		
Run honey	69 291	91 450
Section honey	262 253	422 862
Total	331 544	514 312
In other hives:		
Run honey	89 123	69 254
Section honey	29 004	27 737
Total	118 127	96 991
Grand total	449 671	611 303

Of the 611 303 lbs. produced in 1911, the two eastern Provinces of Ireland supplied the bulk, Ulster giving 204 784 lbs., while Leinster furnished 181 354 lbs.; the westen Provinces (Munster and Connaught) supplied 132 387 and 92 778 lbs. respectively.

The abundance of vegetation and flowering plants has always had a tendency to encourage the production of honey in Ireland.

The usual price paid to producers for comb honey is 9*d*. per lb., while the retail price is 1*d* to 2*d* higher.

Under the Bee Pest Prevention Act (Ireland, 1908) any swarms infected with disease of whatever description may be ordered to be destroyed by local committees of agriculture, with the approval of their respective county councils. Compensation is rendered for all such enforced destruction, and in 1913 the aggregate sum set aside for this purpose was approximately. £ 257.

936 — **Collection and Exportation of the Wax of Wild Bees in the African Colonies.** — MICHEL, E. (Agricultural Engineer at the Ministry of the Colonies) in *Bulletin agricole du Congo Belge*, Vol. V, No. 2, pp. 385-395 + 6 figs. Brussels, June 1914.

This paper contains information on the wild bees' honey in the African colonies, a description of the native methods of bee-keeping in the Belgian Congo, in the Sudan and in Tunis, and of the improved methods of separating wax (melting by solar heat, in a stove, in boiling water).

The trade in wild beeswax is constantly increasing in most of the African colonies, especially in Gambia, Gold Coast, Nigeria, Angola, Sudan, Uganda, British East Africa, German East Africa, Mozambique. A few years ago the exportation of wax from these countries was almost insignificant, while now it amounts to thousands of tons. Wax occupies the third place in the export trade of Angola (Benguela supplying 90 per cent. of the exports of the whole province). Angola exports every year 600 or 700 tons of wax; Mozambique about 100; Portuguese Guinea 50. The wax is exported in cakes weighing 253 to 264 lbs. each. The quantities of wax exported during the last few years from German East Africa and from the British African colonies are given by the following table

Colonies	Year	Exports of wax	
		weight lbs.	value £
German East Africa	1911	802 347	40 488
Gambia	1912	29 498	1 154
Nigeria	1913	12 862	385
Uganda	1912–1913	263 408	—
British East Africa	1912–1913	139 207	7 522
Nyasaland	1912–1913	110 609	5 478
Sudan	1912	43 704	2 379

Wild beeswax when well purified is comparable to European wax. The Central Administration of the Belgian Congo had some samples of wax from the colony examined, and among them many of good quality were found. Bees are widely spread in the Belgian Congo ; the natives extract honey but do not make any use of the wax, the value of which is unknown to them.

FARM ENGINEERING.

937 **Stump Burning to Reclaim "Logged-off Lands".** — ALLISON, LE ROY W., in *Engineering Record*, Vol. 70, No. 4, pp. 95-96. New York, July 23, 1914.

AGRICULTURAL MACHINERY AND IMPLEMENTS

In the Pacific North-West of the United States there are extensive areas called "logged-off" lands upon which forest trees have been felled and which are now covered with stumps varying from 3 to 6 ft. in diameter, intermingled with a successive growth of trees and underwood.

With proper clearing these logged-off lands are very valuable for agricultural purposes. Many methods have been employed for freeing the lands from stumps, such as grubbing, burning, blasting and pulling.

The cost per acre of clearing lends varies considerably with the character of the subsoil, condition of land, etc., but as an average the following may be taken :

Method	Average cost per acre
Powder and horse puller	$ 110
Donkey engine	90
Powder and grubbing	80
Powder and burning	70

A complete land-clearing plant has recently been devised, overcoming some of the disadvantages of the various methods noted and combining most of their advantages It is known as the Blake land-clearing machine and consists of a five-fire Pluto stump burner, a saw, a power grubber and two stump pullers, the whole being operated by a gasoline engine.

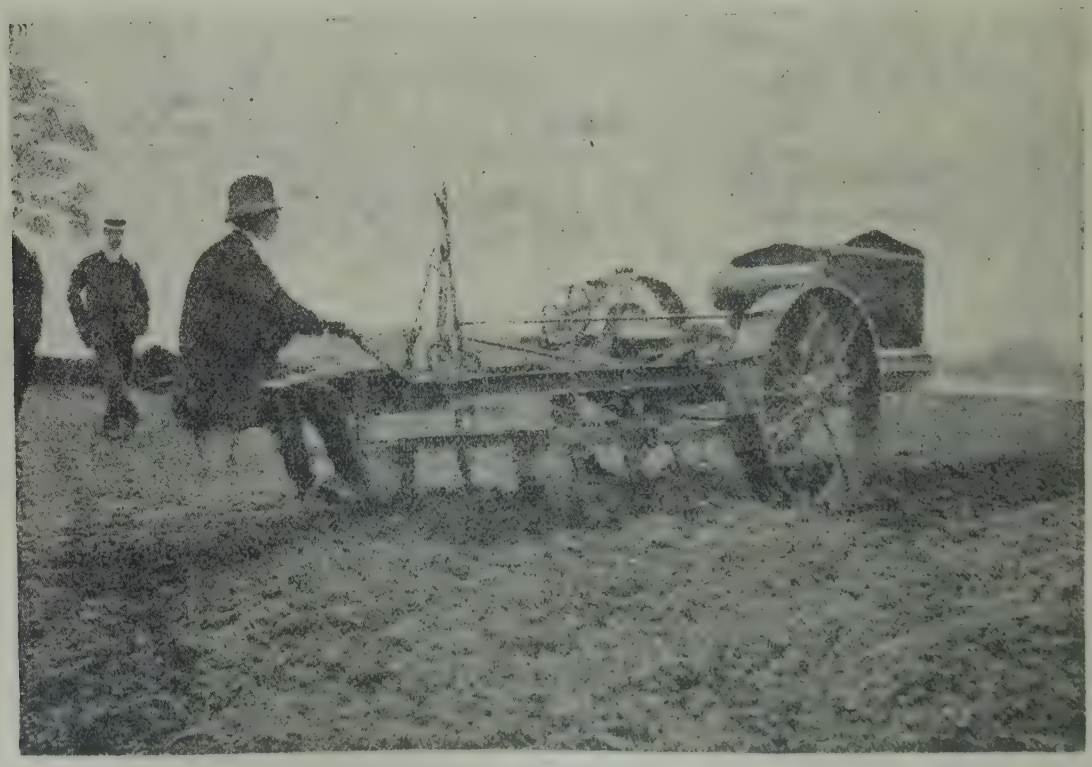
The stump burner is operated by a blower on the machine ; a line of pipe connects the blower to a sheet-iron hood, which is made in four sections and is set over the stump to be destroyed. The use of the burner is simple : a hole is bored down through the centre of the stump and a small explosive cartridge is employed to split it apart. This splitting, while not essential, facilitates the fire started at the top of the stump to gain rapid headway. The hood is then placed over the stump and banked upwith a little earth at the bottom and forms a closed but not air-tight chamber. The fire is started and the pipe connection from the blower is made, after which a constant downblast is turned on the flame. Stumps are consumed in this manner in from 2 to 4 hours or more, according to size. Upon removal of the hood the fire is covered with earth, allowing the roots to charpit to the ends.

Official tests of the burner have been made. During one of them an old water-soaked stump 20 feet in circumference at the base, 13 ft. at the top and 4 ft. high was consumed in 6 hours; the total cost was $ 1.15, divided into 75 cents for gasoline and 40 for explosives.

The method of operating the whole outfit is to set it in a corner of the land to be cleared: five stumps on the immediate vicinity are split, fired and placed under the blower blasts. Meanwhile second-growth trees are pulled out and sawed into cordwood, the roots and snags burned and the undergrowth and small roots are removed with the power grubber. Subsequently the machine is removed to another position and these operations are repeated. By this method a strip of 50 to 100 ft. wide is left ready for plowing and seeding while the outfit is engaged clearing other sections, the whole work being done rapidly at a reduced cost and without waste of the valuable vegetable mold.

938 – **The Garrett-Crawley Agrimotor.** – *The Implement and Machinery Review*, Vol. 40, No. 471, p. 375. London, July 1, 1914.

At the Suffolk Agricultural Association's show, held at Bury St. Edmunds on June 4 and 5, a new tilling machine, the Garrett-Crawley Agrimotor, was shown at work. As can be seen from the accompanying figure



Garrett-Crawley Agrimotor.

it is self-contained and controlled by one man from a seat in the rear. The petrol-driven engine which is situated in front nicely balances the plough shares at the back, so that at the end of the furrow the operator may leave his seat and turn the machine round in its own length on either of the travelling wheels with the utmost ease.

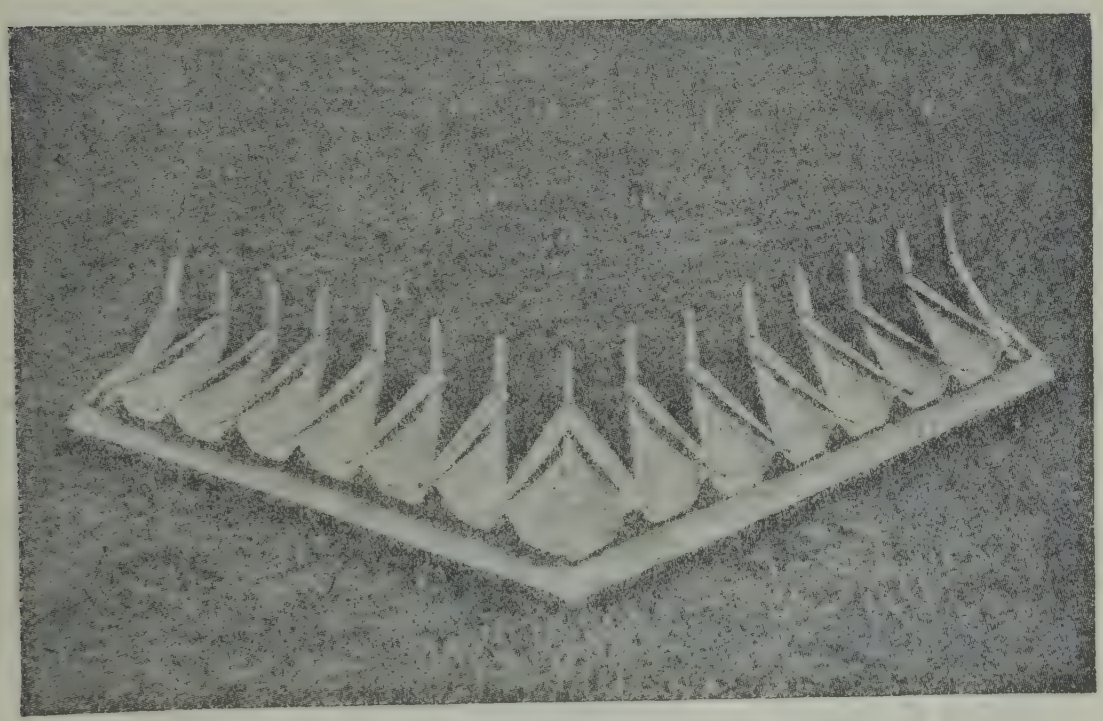
The levers for regulating all the movements of the apparatus are within reach of the operator, one being provided for lifting and lowering the plough and others for declutching either of the wheels, for going forward, stopping or backing, besides a handle for steering. The engine is of 25 H P ; it runs at 1 000 revolutions per minute and can turn over 1 ½ acres per hour to a depth of 5 inches.

When ploughing, one of the road-wheels is raised by means of a hand wheel and worm as high as the depth of ploughing required, while for travelling along a road the plough can be raised by the adjustment of a castor wheel below the driver's seat.

Although primarily a plough, any other farm implement may be attached to and worked by the agrimotor.

939 – **The "Welsh" Bracken Cutter.** — *The Implement and Machinery Review*, Vol. 40. No. 471, p. 390. London, July 1, 1914.

One of the newest implements for the control of bracken is Welsh's bracken cutter. As will be seen from the accompanying figure it consists of a V-shaped frame carrying 15 runners turned up in front, shod with



The « Welsh » Bracken Cutter.

steel and fixed together at the rear by a specially tempered steel plate. The curve given to the front of each runner, together with its individual flexibility, makes easy the "jumping" of any obstruction; the cutting blades and guide plates are so fixed that every bracken stalk which finds its way between the runners is sliced down. The frame, too, is flexible

to enable the machine to keep in close contact with the ground. The implement weighs 1 cwt., is 6 ft. wide and is easily drawn by a horse or pony.

Three or four cuttings may be required the first season and two or three in each of the next three years.

940 – **The Articulated Yoke.** — MANRIN, G., in *Journal d'Agriculture Pratique*, Year 78, Vol. 1, No. 23, pp. 719-722. Paris, June 4, 1914.

M. A. Guérineau's yoke, exhibited at the last Paris Agricultural Show, presents the advantage of maintaining the usual way of fixing the double yoke to the poles of vehicles or to draught chains and at the same time allowing a great freedom of movement to the head of each animal.

The yoke consists of two head-pieces, *A*, *B* (see figs. 1 and 2), of the single-yoke type jointed to the cross-piece *C* which carries the draught gear *T* for the pole or chain.

The head-piece is placed on the neck of the bullock and is attached to the horns with the usual thongs.

In the middle and on the top of each head-piece is fixed a plate, *a* (see section, fig. 3), the top of which bears a pin, *b*, on a turning joint allowing the pin sufficient play to describe an inverted cone; the upper part of *b* is a screw carrying the nut *e*, which causes the counter-plate *c* to press moderately against the plate *a*, allowing a certain amount of play. The plate *c* is strongly fixed by the bolts *d* to the cross-piece *C*. When the nut *e* is in a suitable position, it is fixed there by a hinged piece, *k*, fitting on the square extremity of the pin *b*.

It will be seen in figs. 1 and 2 that the upper surface of the plate *a* is flat, while the under face of plate *c* is a segment of a sphere, thus allowing the pin *b* to move on its turning joint. Fig. 2 shows that plate *a* bears two projections, *n*, *n*, and that the corresponding gaps, *m*, *m*, in plate *c* of the cross-piece *C* are somewhat larger than the projections, so as to allow them play-room and to permit the cross-piece *C* to assume an oblique position in the horizontal plane. The result is that the heads of the oxen enjoy a relative freedom of motion both in the vertical and horizontal directions and independently of each other.

The draught gear, *T*, can be shifted along the cross piece, *C*, so that when animals of different strength are harnessed together the weaker one can be given some relief by the longer lever-arm.

This yoke costs about 31s. It weighs only about 33 lbs., or about 11 lbs. more than the usual yoke.

941 – **Review of Patents.**

Tillage machines and implements.

Austria	66 122. Weeding machine.
	66 134. Coulter-holder for ditching ploughs.
	66 253. Device for regulating the depth of work of gang ploughs.
	66 263. Apparatus for ploughing-in all kinds of manures by ploughing machines.
Belgium	264 848. Device for fixing the extensible axle in the fore-carriage of ploughs.
	264 850. System of fixing the adjustable point of ploughshares.
	265 027. Plough.

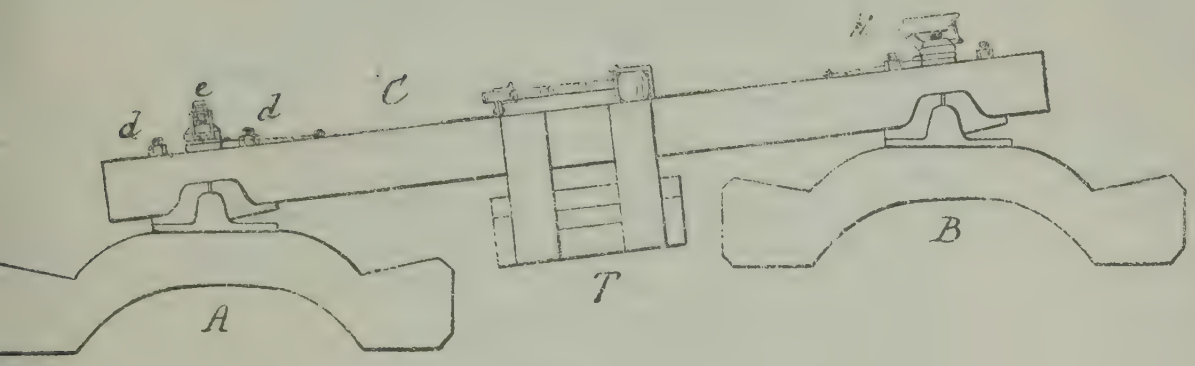


Fig. 1.

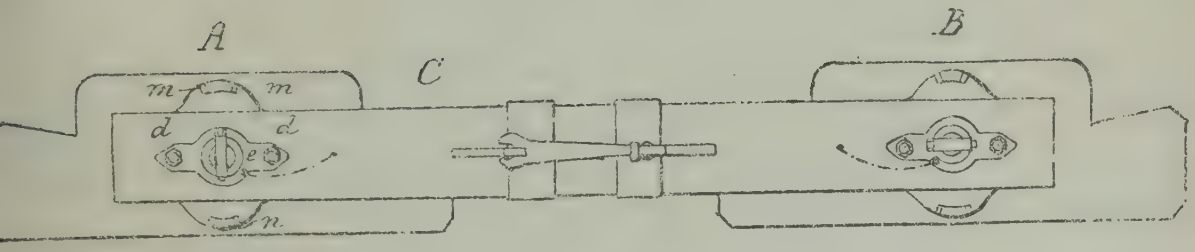


Fig. 2.

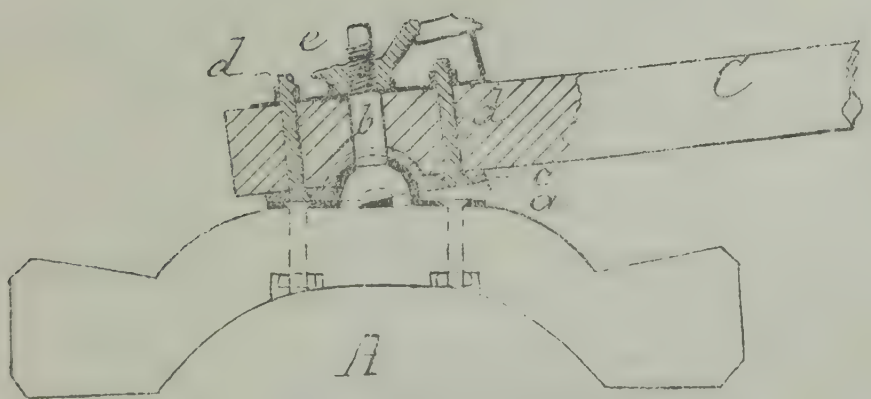


Fig. 3.

GUÉRINAU'S. — Articulated Yoke.

Canada	153 923. Plough coulter.
Germany	203 626. Tilling implement with harrow teeth and hoes.
	273 777. Motor tilling machine with spades turning sideways also.
	273 907. Turn-wrest plough with revolving beam.
	274 139. Turn-wrest plough.
	274 141. Driving wheel for motors, especially for ploughing.
	274 435. Plough with jointer.
	274 436. Plough for motor traction.
Hungary	63 459. Balance plough.
	63 509. Plough with revolving screw in front of share.
	63 521. Implement for hoeing and rolling between rows of beets.
	63 601. Turn-wrest plough.
	63 656. Hoeing and banking machine.
	64 631. Rotary digger.
	63 686. Motor plough.
	63 719. Horse-hoe.
	63 777. Electric auxiliary apparatus for two-engine ploughing.
	64 114. Cultivator hoes.
	64 214. Gang plough.
	64 243. Hoes for rotary diggers.
	64 307. Fork-like supports for mouldboards.
	64 346. Apparatus for machine ploughing.
	64 414. and 64 436. Improvements in motor ploughs.
	64 430. Motor windlass for ploughs.
	64 506. Harrow.
Italy	140 763. Improvement in tractor ploughs.
	134 426. Tillage machine.
	140 516. Improvement in the driving of windlasses in machine ploughing.
	140 369. Rotary digger.
	153 755. Pulifici's new system of haulage for ploughs.
	141 143. System of lubricating ploughshares with water, or water mixed with other substances, by means of the hollow bolts which fix the share and mouldboard to the body of the plough.
	141 594. Improvement in disk harrows.
	136 513. Innovations in ploughs.
	140 406. Tractor for ploughs with steering wheel or system of steering wheels situated in front of driving wheel.
United Kingdom	1 816. Motor ploughs.
	2 400. Motor plough hauling itself along a rope anchored at both ends.
	3 455. Weeding and cultivating machines.
	3 458. Land rollers.
	3 578. Cultivating machine for digging or pulverizing land.
	3 651. Land-cultivating machine.
	3 966. Ploughs.
	4 496. Rotary tool for cultivators, etc.
	5 254. Spade, shovel and fork handles.
United States	1 097 908. Pulverizing and smoothing harrow.
	1 099 080. Potato hiller and weeder.
	1 099 877. Adjustable subsoiler attachment.
	1 099 304. Cultivator shovel.

1 099 897. Ploughshare.
1 100 395. Pulverizing implement for the treatment of fallow and other land.
1 100 620. Deep tilling attachment.
1 100 938. Sulky plough.
1 100 988. Five-horse cultivator equalizer.
1 101 348. Gang plough.
1 101 158. Plough coupling.
1 100 920. Subsoil plough.
1 101 777. Hitch for gang ploughs.

Manure distributors.

Canada 153 402. Manure spreader.
153 453. Fertilizer distributor.
France 468 069. New manure spreader for vineyards.
Italy 141 770. New manure spreader for vineyards.
United States 1 098 502. Manure loader.
1 099 845. Manure spreader.

Drills and sowing machines.

Austria 66 138. Feed wheel for potato planters.
66 140. Feeding gear for potato planters.
66 245. Potato planter.
66 254. Drill with force feed and hopper with moveable back.
Canada 153 399. Double disc attachment for drills.
Denmark 18 970. Sowing machine for beets, cabbage and beans.
Germany 274 232. Apparatus for sowing grass seeds.
Hungary 63 504. Drill.
63 661. Attachment for wheels to prepare holes for planting potatoes.
64 226. Device for drill hoppers.
64 474. Potato planter.
Italy 140 732. Disk distributor for sowing machines.
140 609. Knapsack sowing machine.
140 639. Beet sowing machine and manure spreader combined.
125 117. Hand sowing machine with distributing disk driven by a cord.
United Kingdom 2 869. Agricultural drills.
5 765. Seed drill.
United States 1 097 611. Land marker for planters.
1 098 416. Sowing machine.

Reapers, mowers, etc.

Canada 153 448. Binder tractor.
153 451. and 153 506. Binder mechanism.
153 508. Bundle carrier.
153 509. Loader for binders.
153 523. Harvester mechanism.
153 936. Harvester cutting mechanism.
153 976. Shocker.
153 999. Sharpener for lawn mower.
154 006. Shocking machine.
France 469 569. Universal fore-carriage for harvesting machines.

Germany	273 728.	Tedder with adjustable tine bars.
Hungary	63 723.	Improvements in two-axle motor mowers.
	63 788.	Mower.
	64 023.	Mower with circular knife.
	64 062.	Steering gear for mowing and reaping machines.
	64 289.	Implement for tying sheaves.
Italy	138 157.	Complete mower cutter-bar with two cutting sections moved in alternate directions and light divider.
	140 560.	Rotatory mower.
	139 881.	Sharpener for blades of mowers.
	131 477.	Side delivery rake.
	141 768.	Process and apparatus for hardening scythes by compression and curving them.
	141 785.	Counting apparatus for binders.
Switzerland	65 865.	Canvas for binder.
	66 053.	Swath rake.
United Kingdom	1 574.	Lawn mowers.
	1 751.	Harvesting flax.
	4 108.	Mowing machine swath board.
	4 820.	Mowing machine.
	5 892. 5 993. 6 251.	Side-delivery rakes.
United States	1 097 821.	Mowing machine divider rod attachment.
	1 097 693.	Corn harvesting machine.
	1 099 495.	Flax and grass seed harvester attachment for mowing machines.
	1 099 407.	Harvester.
	1 099 591.	Corn topper.
	1 101 393.	Sugarcane harvester.
	1 101 758.	Mowing machine.
	1 101 607.	Corn gathering and husking machine.

Machines for lifting root crops.

Belgium	265 299.	Potato lifter.
Denmark	18 875.	Beet-topping machine.
Germany	274 307.	Potato lifter with side wheel, one share for cutting the vines, one for lifting the potatoes into a drum-shaped sieve running on the ground.
Hungary	63 992.	Beet topper.
United Kingdom	1 072.	Potato harvester.
	4 334. and 5 178.	Potato diggers.
United States	1 097 990.	Potato digger.
	1 099 414.	Beet topper and harvester.
	1 099 643.	Beet harvester.
	1 101 584.	Topping device for sugar-beets.

Threshing and winnowing machines, etc.

Austria	66 121.	Cereal husking machines.
Belgium	264 857. and 265 195.	Threshing machines.

Canada	153 796.	Thresher.
France	468 340.	Improvements in the mechanical feeders for threshing machines.
Germany	274 233.	Step-shaped caving riddle for threshers.
	63 569.	Improvement in threshers.
	63 637.	Winnowing and grading machine.
	64 612.	Regulator for winnowers.
	64 055.	Sack stand for threshers.
Italy	140 886.	Automatic feeder for threshers.
Switzerland	65 886.	Sheaf opener.
	66 314.	Apparatus for cleaning, sorting and airing grain.
United Kingdom	3 663.	Threshing machine.
	5 958.	Dust-removing apparatus for threshing and other agricultural machines.
United States	1 098 560.	Grain thresher.
	1 098 803.	Grain separator.
	1 099 339.	Corn sheller.
	1 100 150.	Threshing machine.
		Other agricultural machines.
Austria	65 908.	Ribbon-shaped earmarks for animals and pincers for same.
	66 124.	Apparatus for taking electricity from a line for electrically-driven agricultural machines.
	66 244.	Motor lorry with windlass.
	66 249.	Iron wheel for agricultural machines.
	66 258.	Apparatus for hammering scythes.
	66 142.	Drive for butter-making machine.
	66 144.	Injector.
	66 252.	Apparatus for destroying insects.
	66 259.	Groat mill.
Canada	153 403.	Tractor.
	153 416.	Tractor truck.
	153 433.	Straw spreader.
	153 465.	Hay stacker.
	153 471.	Egg turner.
	153 485.	Stump puller.
	153 525.	Hay loader.
	153 555.	Milking machine.
	153 612.	Grain steeping machine.
	153 686.	Churn.
	153 800.	Butter-making machine.
	153 826.	Fruit evaporator.
	153 845.	Milking apparatus.
	153 863.	Fruit-packing implements.
	153 916.	Loader for hay.
Denmark	18 967.	Teat cup.
	18 995.	Bruising mill.
	19 002.	Mill.
	19 029.	Automatic crib.
Germany	273 569.	Apparatus for electric automotor agricultural machines.
	273 729.	Apparatus for cleaning and removing rust from chopped fodder.
	273 730.	Device for fixing ladders to trees.
	274 140.	Three-wheeled tractor with driving fore-wheel for agricultural machines.

274 182. Fodder truck with inclined bottom and side apertures regulated by sliding panels.
274 183. Automatic feeding device for live stock.
274 184. Automatic trapdoor for poultry houses.

Hungary
63 510. Apparatus for tying bundles of straw, sticks, etc.
63 786. Potato peeler.
63 805. Apparatus for unloading carts.
64 385. Chaff-cutter with fan.
64 361. Cabbage and beet slicer.

Italy
140 419. Improvement in plunger pumps for sprayers.
140 913. Machine for cutting the roots of hemp.
141 154. Universal grape crusher and must separator.
140 894. Process and apparatus for extracting oils by pressure.
140 460. Mechanical lifting apparatus for straw elevators.
141 707. Yoke.
140 175. Automatic jet for water or other liquids.
141 937. New sulphurer with moveable horizontal cylindrical sieve.

Switzerland
65 867. Moveable hothouse.
65 908. Mechanism for dried milk works.
65 911. Apparatus for flaying animals.
66 054. Automatic loading of hay-carts.
66 058. Device in concrete mangers for the watering of cattle.
66 117. Apparatus for emptying vacuum milking machines.
66 250. Box for conveyance of cattle.
66 251. Device for preventing horses from shying.
66 312. Apparatus for steriliising milk and other liquids that are easily decomposed by heat.
66 313. Apparatus for producing a uniform degree of moisture in cereals.

United Kingdom
987. Trap nests for poultry.
1 015. Portable feeding device for draught animals.
1 504. Delinting cotton seed.
1 668. Cow milkers.
1 672. Fastenings for butter churns.
2 028. Apparatus for sterilizing soil.
2 069. Appliance for cutting up maize stalks.
2 353. Moulding device for making hay ricks, corn stacks, etc.
2 766. Apparatus for preparing peat.
2 927. Centrifugal separators.
3 138. Apparatus for preparing cultures of lactic bacteria.
3 193. and 3 350. Cutters for tapping rubber trees.
3 248. Hop-picking machine.
3 262. Potato grader.
3 333. Kneading machine.
3 364. Cow milkers.
3 534. Butter blender.
3 610. Cotton gin.
3 830. Milk churn lids.
4 202. Cotton-picking machine.
4 400. Brushes for killing insects.
5 686. Machine for decorticating nuts.

5 687. Mill for cracking nuts.
5 900. Fruit-picking appliance.
6 037. Bale tying-tongs.
6 180. Cow milkers.
6 183. Egg-testing devices.
6 314. Sugarcane mills.

United States
1 097 887. Grain and seed cleaner.
1 097 853. Horse hay fork.
1 098 221. Implement for transplanting and replanting small plants.
1 097 723. Steering device for traction engines.
1 098 602. Baling press alarm.
1 098 553. and 1 099 190. Hay stackers.
1 099 088. Tongue truck.
1 099 319. Wire fence stretcher.
1 099 311. Hay loader.
1 099 538. Traction engine.
1 099 778. Bean separating machine.
1 099 201. Handhold for implements.
1 100 123. Draught equalizer.
1 100 592. Baling press.
1 100 370. Adjustable wagon tongue.
1 100 350. Apparatus for raising and lowering vehicle bodies.
1 100 908. Cotton picking machine.
1 109 968. Grain shock scoop.
1 100 950. Fodder cutter discharge-pipe.
1 100 970. Windmill oiler.
1 101 170. Hay carrier.
1 101 543. Windmill.
1 101 856. Seed corn tester.

BUILDING CONSTRUCTION

942 – **Pig Stye with Device for Protecting Sucking Pigs and Keeping them Warm.** — *Deutsche Landwirtschaftliche Presse*, Year XLI, No. 25, p. 315. Berlin, March 28, 1914.

Pig breeders often suffer losses through the sucking pigs being crushed under their mothers. As a means of preventing such accidents a special compartment is sometimes set apart for the sucking pigs; recently Herr Lüdemann has taken out a patent (No. 271 340) in Germany for warming this compartment and thus inducing the young pigs to stay there permanently.

The accompanying figs., 1 and 2, show the new stye in plan and section. It is about 6 ft. 6 in. × 10 ft. and provided as usual with a feeding-trough at one end. At the other end a pit about 10 inches deep and 20 wide runs all along the side of the stye; it is covered by a double sheet-iron cover, with an air-space between the two sheets, laid flush with the floor. This box cover can be heated either by a few petroleum lamps placed under it or by steam or electricity; b^1 and b^2 (fig. 2) are openings for the admission of air and for the escape of the products of combustion. At about 14 inches above the warm surface a plank, *f*, is fixed horizontally to the wall. Besides this a rail of wood about 6 in. square is laid on the floor and fixed at 20 to 28 inches from the pit and parallel to it.

The sucking pigs, as experience has proved, seek the warmest place in the stye, that is the sheet-iron cover (on which soft straw is laid), while

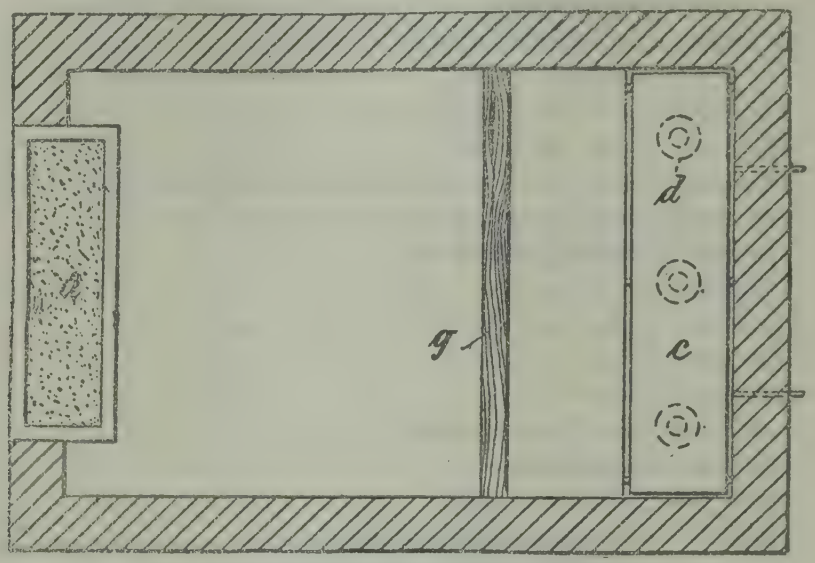


Fig. 1. — Stye for brood sow. — Plan.

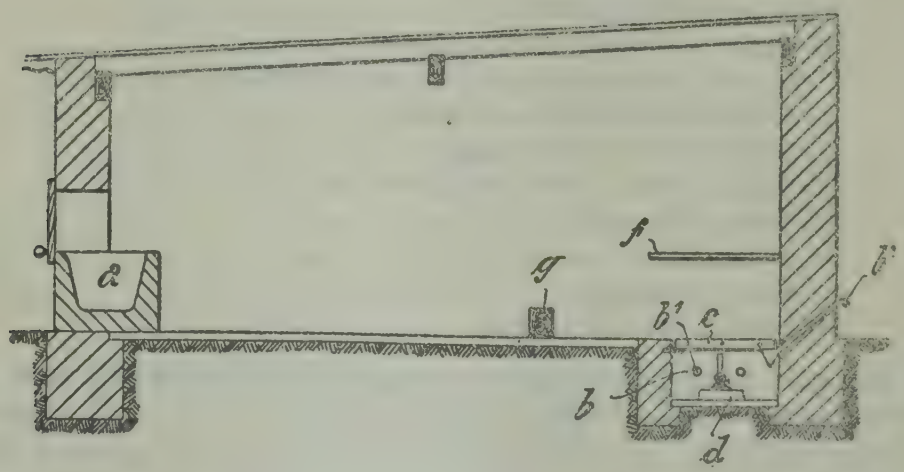


Fig. 2. — Stye for brood sow. — Longitudinal section.

the mother is kept off it by the plank, and lies down with her back against the rail g to suckle her offspring, which are thus absolutely safe from the danger of being crushed.

RURAL ECONOMICS.

943 – **Book-keeping Statistics on the Profitableness of Bee-keeping in Switzerland in 1912-13** (1). — Report of the Swiss Peasants' Secretariat, in *Schweizerische Bienen-Zeitung*, No. 8. Aarau, August 1914.

This Report contains the results obtained by 28 bee-keepers entered on the books of the control section of the Association of Swiss Bee-keepers

(1) For the results of the 1912 enquiry included in the preceding Report of the Swiss Peasants' Secretariat, see No. 170, *B.* Feb. 1914. (*Ed.*).

for the year 1912, and by 25 entered for 1913. These have kept regular accounts of their apiaries according to the uniform method adopted by the above section, and have placed them at the disposal of the Association, which in its turn handed them over to the Swiss Peasants' Secretariat to check and work up statistically.

In order to illustrate the method that has been followed The Table on pp. 1356-1357 gives the principal figures of these statistics.

The economic results of these 25 bee-farms cannot be generalized; nevertheless they confirm the well-known fact that both 1912 and 1913 were bad bee years in Switzerland. From the experience gained by the Swiss Peasants' Secretariat in the matter of statistics of farm book-keeping, it appears that the accounts of 100 bee farms would be sufficient to draw conclusions for the whole country.

Carefully made statistics of the accounts of bee-keepers in Switzerland are useful not only to each bee-keeper who keeps regular accounts, but also to the collectivity of bee-keepers. Consequently the Association of Swiss Bee-keepers solicits the co-operation of a greater number of contributors to this statistical enquiry, with the object of being enabled to draw general conclusions; for this purpose it supplies at a moderate price the forms for bee-keeping accounts

AGRICULTURAL INDUSTRIES.

INDUSTRIES DEPENDING ON PLANT PRODUCTS

944 – **Wine Making without Refrigeration in Warm Countries.** — GAUVRY, E., in *Bulletin de la Direction Generale de l'Agriculture*, Year 18, No. 78, pp. 389-409. Tunis, June 1914.

Refrigeration is generally considered as the final solution of the difficulties of making wine properly in warm countries. Even if not properly applied it produces finer wines, richer in bouquet. But refrigeration, either curative or preventive, requires expensive and extensive plant when, the amount of vintage to be converted into wine daily becomes considerable, and though, notwithstanding its high cost, it is still the best means of ensuring a perfect vinification even during the most violent sirocco, it is frequently difficult or impossible to use on account of the insufficient quantity and sometimes total lack of water at vintage time.

It thus became necessary to discover palliatives in order to obtain sound products with good keeping qualities in spite of the unfavourable conditions obtaining during the time of wine making. In Algeria this has been attained by the systematic use of sulphurous anhydride in heavy doses, either at the moment the vintage is placed in the vats or during the course of fermentation. But in Tunis the conditions of fermentation are still more unfavourable than in Algeria, so that the writer considers it necessary to know exactly how sulphurous anhydride behaves towards the component parts of must and what are its chemical and biological effects, in order to get the maximum benefit from its judicious use.

Book-keeping Statistics on the Profitableness of Bee-keeping in Switzerland (see page 1354 .
Principal average statistical data from the 1913 *enquiry compared with those of* 1912.

	Per bee farm						Per hive						Percentage	
	1912			1913			1912			1913			1912	1913
	£	*s*	*d*	£	*s*	*d*	£	*s*	*d*	£	*s*	*d*		
Capital.														
Total of capital in plant	46	5	6	43	2	6	1	16	4.8	1	11	9.6	46.30	45.69
Total of capital in produce	52	15	3	49	18	6	2	1	4.8	1	16	9.6	52.80	52.92
Current expenses		15	3		19	0			7.2			8.5	0.75	1.02
Credits		3	3		7	0			1.9			3.1	0.15	0.37
Total capital	**99**	**19**	**3**	**94**	**7**	**0**	**3**	**18**	**6.7**	**3**	**9**	**6.8**	**100.00**	**100.00**
Cash account.														
Receipts: Honey, hives, swarms, queens, wax, honeycombs	18	8	10	8	15	2		14	5.8		6	5.6	98.50	97.52
Glasses, boxes, etc		1	7		4	0			0.5			1.6	0.45	2.09
Produce of capital in plant		4	0			10			1.9			0.3	1.05	0.39
Total receipts	**18**	**14**	**5**	**9**	**0**	**0**		**14**	**8.2**		**6**	**7.5**	**100.00**	**100.00**
Outlay: Sugar, implements, repairs, sundries	8	2	0	6	9	6		6	4.3		4	9.2	63.47	55.63
Swarms, wax, honeycombs	1	10	5		15	3		1	2.4			6.6	12.01	6.46
For the capital in plant	3	2	5	4	8	0		2	5.3		3	2.9	24.52	37.91
Total outlay	**12**	**14**	**10**	**11**	**12**	**9**		**10**	**0**		**8**	**6.7**	**100.00**	**100.00**
Supplied by hives to the household and private persons.														
Honey, hives, swarms, queens, wax, honeycombs, sugar	2	8	8	1	19	0		1	8.9		1	5.2	100.00	100.00
Supplied by household and private persons to hives														
For the working and capital in plant; swarms, honeycombs, etc.		11	10		11	1			5.6			4.9	100.00	100.00
Control of honey.		lbs.			lbs.			lbs.			lbs.			
Honey collected		313			138			12.30			5.07			

Swarms, queens, etc.	4	4	9	—	6	6	3	3·7	—		2.7	21.45	—	3.63
Wax and honey combs	1	3	3		13	6		10 9			5.9	5.90		7·99
Total gross returns	**19**	**13**	**6**	**8**	**6**	**3**	**15**	**5.2**		**6**	**1.8**	**100.00**		**100.00**
of which: sold	17	9	3	6	7	3	13	8.4		4	8.5	88.70		76.50
delivered to household	2	4	3	1	19	0	1	8.9		1	5.2	11.30		23.50
Working expenses.														
Sugar	6	4	9	5	11	3	4	10.9		4	1.1	28.96		29.94
Small implements and their amortizement		13	6		11	3		6.4			5.0	3.15		3.03
Expenses for hives » » »	1	0	0	1	0	0		9.2			8.7	4.55		5·33
Expenses for hive houses		18	6		16	0		8.5			7.2	4.18		4.40
Sundries	1	15	3	1	10	6	1	4.7		1	1.4	8.23		8.22
Compensation for work of beekeeper, 9 ½*d* per hour	5	19	3	4	8	0	4	8.2		3	2.8	27.64		23.64
Total working expenses	**16**	**11**	**3**	**13**	**17**	**0**	**12**	**11.3**		**10**	**2.2**	**76.71**		**74.56**
5 per cent. interest on capital	5	0	9	4	14	6	3	11.3		3	5.8	23.29		25.44
Total cost of production	**21**	**12**	**0**	**18**	**11**	**6**	— **16**	**10.6**		**13**	**8.0**	**100.00**		**100.00**
Net returns.												per cent. of capital		per cent. of capital
Gross returns minus working expenses	**3**	**2**	**6**	— **5**	**9**	**6**	—	**2**	**5.3**	—	**4**	**0.6**	**3.10**	—	**5.82**
Revenue.												per hour of work		per hour of work
Net returns plus compensation for work	**9**	**1**	6	— **1**	**2**	**0**		**7**	**1.4**			**9.8**	**1s 2.6*d***	—	**0s 2.4*d***
Compensation for work.														
Revenue minus 5 per cent. interest on capital	**4**	**0**	**9**	— **5**	**16**	**9**		**3**	**1.9**	—	**4**	**3.5**	**0s 6.5*d***	—	**1s 0.8*d***
		s	*d*		*s*	*d*									
Sale price of honey per pound			10.4		1	2. 3									
Cost of production of honey per pound		1	0.6		2	0.1									
Profit (+) or Loss (—) per pound.	—		2.2	—		9.8									

The ferment of wine presents, according to climate and locality, varieties or strains which impart to the product obtained a special bouquet, but this differentiation is caused also by a natural selection produced by adaptation to environment, to the conditions of wine-making and to the must, the composition of which is not invariable and the elements of which are modified by outside factors.

In warm countries, where the grapes attain full maturity, they are covered by very vigorous and active ferments: these are already adapted to the manner of fermentation of the country and it is they that have to be selected in order to obtain the best results when only wines of current consumption are considered. Commercial selected ferments yield in Tunis too uncertain results to allow of their employment except as a means of increasing the regularity of fermentation. Sulphurous anhydride, even in moderate doses, ensures a sufficient purification. But the ferment of mannitic fermentation and that which causes the turning of wine resist, and they are all the more dangerous inasmuch as their development is favoured by high temperatures. Their evolution may be stopped by increasing the acidity of the medium. Without this circumstance their presence would be permanent in Tunisian wines, the musts of which are always too rich in sugars, with a relatively too low acid content. One must not hesitate to acidify by means of tartaric and citric acid; but while citric acid presents remarkable advantages its use is much restricted by present legislation. With the assistance of acidification the treatment of musts with sulphurous anhydride ensures from the very beginning a practically sufficient bacterial purification to allow fermentation to set in and to develop in the best conditions.

This is the moment in which, in warm countries, the enlightened practical wine maker must interfere to dominate the evolution of the ferments and moderate their activity, as under such conditions they always have a tendency to act too rapidly. The rise in temperature which is so injurious to them is due chiefly to this excess of activity. Ferments, though aerobic, continue to proliferate even when they are deprived of oxygen; further, their activity continues by the emission of a special diastase, zymase, which has the property of instantly transforming grape sugar into alcohol and carbon dioxide, and which does not appear except under anaerobic conditions. The use of large amounts of sulphurous acid is based on these facts, as it obliges the ferment to live from the beginning an anaerobic life in a de-oxygenized medium. On the other hand it is natural that in order to start fermentation in musts treated with sulphurous acid, a ferment in full activity, whose cells have lived in contact with air so as to ensure the maximum of diastatic activity, is necessary. For this purpose an abundant ferment is prepared and the must is leavened with it. This is but a slight complication in the usual methods of wine-making.

The especially prepared ferment seems to be very advantageous, as it is particularly suitable for multiplying and working in a sulphurized liquid; it is used in priming, being placed in the bottom of a vat before filling. The thorough mixing is then performed by a pump. In order to

have a regular action of the ferment in the whole mass, the grapes are freed from the strigs in the case of red wine. This gives finer wines and allows an economy in the capacity of vats, casks, presses, etc., as well as in the labour required for the various manipulations.

In order thus to keep fermentation under the best conditions the above considerations must be borne in mind. In Algeria the *modus operandi* followed by the majority of vine growers varies more or less in details, but is everywhere based on the suppression of refrigeration and on the systematic use of sulphurous acid. For some years past the use of sulphurous acid has been quite scientifically applied by the perfecting of BARBET'S system of wine-making. By this process an absolutely sterile must can be obtained and set to ferment with selected ferments.

Vinification may be retarded at will; in warm countries it may be deferred to the winter months, and this is not the least interesting aspect of the process for Tunis. The possibility of blending musts of different kinds also arises, allowing of the preparation of a single juice of uniform composition for the year.

With the object of obtaining a prolonged state of inactivity in the must, enormous doses of sulphur dioxide have to be employed, and in these conditions even a very active aeration cannot eliminate enough of it to allow fermentation to be set up. BARBET has also solved this difficulty by causing the must to fall through a column of plates in which it is traversed by an ascending column of air. But this method has not received the favour it deserves on account of the price of the apparatus. DEPATY'S desulphurizer, which is based on the principle of aeration by warm air, being cheaper is preferred. Good quality products are thus obtained, but their cost price is still high.

At present experiments are being carried out at the Tunis Laboratory, which promise a much simpler solution of the problem, namely of causing a partial desulphurization of the must, sufficient to allow a regular fermentation by means of ferments accustomed to sulphurous acid.

945 – **Refrigeration in Wine Making.** — LABARDE, J., and DELBAVIE, J., in *L'Industrie frigorifique*, Year 12, No. 135, pp. 179-191. Paris, June 1914.

In a report on the work carried out by the Oenological Commission for the South West of the "Association Française du Froid", the results of experiments made, according to a programme of research, on the effect of cold on wines are given.

The subjects to be studied were: 1) The treatment of wines by short and rapid refrigeration according to the process usually adopted by the "Compagnie générale aérohydraulique"; 2) Slow and prolonged refrigeration in cold chambers at different temperatures: about 0° C. and — 3° C. (32° F. and 26.6° F.). The following wines were experimented upon: *red wines*, Génissac, Château Nodoz, Anglade du Blayais, Bas Médoc; *white wines*, La Brède, Les Salles de Castillon.

The above Company's plant for rapid refrigeration consists essentially of two parts: 1) a refrigerating system; 2) some cooled vats. On leaving the refrigerator the wine is sent into vats of the capacity of 1100 gallons, in

which it usually remains a week ; it is then racked and sent to a filter where it is clarified at a temperature which is still fairly low.

In order to estimate the effect of these treatments, the wines were tasted and submitted to chemical analysis.

Considering only the concordant results of the second and third tasting, undertaken at a time when the wines had in all likelihood assumed their state of equilibrium, refrigeration applied according to the various methods to red Gironde wines proved favourable three times out of four. Among white wines, in the La Brède wine the improvement was more marked at the second tasting than at the first ; the Castillon wine was improved by the complete treatment by rapid refrigeration, while refrigeration alone did not yield the same results.

The analytical data obtained from the wines experimented upon are collected in tables and they show that rapid cooling determines in general a slight thinning of red wines. Rapid cooling and filtering acts particularly on the flavour of the wines, improving it. Prolonged refrigeration in cold chambers has in general a more prononced effect than the former treatment. On tasting wines subjected to it they are generally classed first of all.

The differences observed in tasting were always very slight, and were considered by the tasters, who classified the wines with the greatest care, as in general only shades.

The object aimed at by the Commission was to know if the use of artificial cold on wines could have the same effect as natural cooling. In some localities this cooling may extend over a fairly long period and with sufficient intensity, without however attaining the freezing of the wine, and according to current and very old observations the result is always favourable to the actual and future quality of the wine.

The experiments of the Bordeaux Commission, though limited to a small number of wines, prove that by artificial cooling the principal advantages attributed to natural cooling may be obtained.

The number of white and red wines studied is, no doubt, insufficient to allow of much generalization of results, and if the Commission limited itself to this number, it was because the programme of the experiments contemplated the study of multiple conditions of the application of artificial cold. It has been recognized for the moment that rapid refrigeration has not given very marked results ; on the other hand observations have been clearer as to the prolonged stay of the wine in cold chambers. In the future, investigations must be made with the object of obtaining the maximum effect of low temperature in the shortest time. There is thus a whole series of new experiments to be made and the Commission hopes to be able to continue its researches.

946 — **A New Method of Making Wine and of Utilizing the Pomace.** — Monti, E. in *Giornale Vinicolo Italiano*, Year 40, No. 33, pp. 769-772. Casale Monferrato August 16, 1914.

In view of the fact that within certain limits wine is all the richer in alcohol and perfume the slower the process of fermentation has been, and

ecalling that some years ago he had prepared a partially fermented and ıtensely coloured must (" enocyanine krios ") to be added to light wines ith the object of increasing their alcohol content and colour, Sig. Monti bserves that by retarding the commencement of fermentation, time is iven to the must to dissolve the colouring matter, the acids, the albumi-oids and the other substances contained in the pulp adhering to the pips.

This observation, together with the consideration that the only means f obtaining a harmless sterilization is moderate heat, and that in must ıe disadvantageous separation of albuminoid and phosphatic matter oes not take place under 60° C. (140° F.), suggested to the writer a new ıethod of wine making which the director of the *Giornale vinicolo* (E. Ot-avi) considers a real and important discovery.

The writer proposes to exhaust the fresh pomace systematically by iluted must heated to 55-60° C. (131-140° F.), thus ensuring the complete eparation of the sugar, colouring matter, acids and other useful substances ontained in it. The result of the operation is a liquid possessing a density qual, or only slightly inferior, to that of the must obtained by the first ressure, and of an intense colour. On cooling, all the argol contained in ıe pomace separates completely and on concentrating the liquid by conti-ıous freezing, or *in vacuo* in an apparatus heated by warm water, a juice obtained containing from 60 to 75 per cent. of sugar. It is so intensely ɔloured as to require from 10 to 30 volumes of water, according to the uality of the grapes used, to bring it down to the intensity of colour of ɔmmon wine. This product, which the writer calls " Estratto integrale uva " (whole grape extract) keeps absolutely unchanged for years. It ıay thus be prepared in large quantities in years of plenty and used to ıprove the wines produced in years of bad or insufficient vintage.

This extract may be prepared from common black grapes or from ıe or white varieties, of which it retains the perfume; it is very useful for ıproving wines poor in tannin or solids. The addition of this extract to the ust increases the quantity of wine by 10 or 15 per cent., and to a slight xtent its alcoholicity, besides imparting to it a more delicate flavour and erfume. The preparation of this extract allows a fuller utilization of the ɔmace.

7 – **Determination of the Tartaric Acid in Wines by Physico-Chemical Volumetric Analysis.** — DUBOUX, MARCEL, in *Annales de Chimie Analytique*, Year 19, No. 3, pp. 89-97. Paris, March 15, 1914.

The processes for determining the total tartaric acid in wines under ıe form of potassium bitartrate present the following great drawback: ıe deposition of the crystalline precipitate requires from one to three ıys and the results are not independent of the method followed. The writer ıs thus endeavoured to effect this determination by the method of elec-ic conductivity or physico-chemical volumetric analysis, which allows ıe rapid and precise determination of the following elements of wine: h, potash, lime, magnesia, sulphates, chlorides, phosphates, ammonia, idity, alkalinity, etc. The physico-chemical method presents in all cases marked advantage over volumetric or gravimetric methods, and this has

induced several chemists to adopt it in connection with the usual analytical methods (1).

The study of the determination of tartaric acid in wine by means of conductivity shows that this method is of interest to the chemist who already analyses wines by physico-chemical volumetry. Knowing the acidity of a wine and its exact content in sulphates, he can by a simple titration which takes only 10 to 15 minutes, determine the total tartaric acid in the wine with a precision equal if not superior to that obtained by the usual methods. These results are always rigorously exact in the case of wines of low acidity. They are somewhat less exact when the wines contain an abnormally high quantity of malic acid. If the wine under examination had been treated with citric acid this would would be counted as tartaric acid. It would then be advisable to determine the tartaric acid by the bitartrate method and the citric acid by difference.

The writer describes the technique of the operations and the reagents employed for precipitation (nitrates of lead, silver, lanthanum and uranyl, barium chloride and acetate, caustic baryta). He gives two precipitation curves and the results of the determination of tartaric acid by physico-chemical volumetric analysis in a white wine and in a red one. He then compares in a table the results obtained: 1) by the German official method; 2) by the French official method; 3) by the conductivity method. These figures show that: 1) for wines containing not much acidity, the three methods yield results which agree well with each other; 2) with very acid wines the agreement is not so complete; 3) the official French process yields too low values when the wine contains large quantities of sulphates.

INDUSTRIES DEPENDING ON ANIMAL PRODUCTS

948 – **Ratio between the Specific Gravity of Cow's Milk and its Percentage Content of Fat and Dry Matter.** — FLEISCHMANN, W., in *Journal für Landwirtschaft*, Vol. 62, Part 2, pp. 159-172. Berlin, 1914.

The writer compares the best known formulae for calculating one of the three quantities (specific gravity, fat content and dry matter) from the other two and concludes that all the formulae, even the relatively most precise, are only approximative and can only by chance in some cases yield results which agree with those obtained by analysis.

Considering, however, the uncertainty of determining analytically the weight of the dry matter in milk, it is preferable to determine it by calculation rather than by direct determination, provided formulae which give the nearest possible approximation be used, and the greatest care be taken in determining fat content and specific gravity.

The formula recommended is the following:

$$t = \frac{4.8 \times f \times d}{4} + 0.25$$

in which t = dry matter
f = fat content
d = degrees of lacto-densimeter.

(1) See article by PAUL DUTOIT and MARCEL DUBOUX: "Analysis of Wines by Physico-chemical Volumetric Method." — *B.* Dec. 1912, pp. 2562-2569. (*Ed.*).

The results obtained by this formula agree very nearly with those yielded by Fleischmann's well-known formula.

949 **An Investigation into the Composition of Cheese made from Whole Milk.** — BROWNLEE, G., in *Department of Agriculture and Technical Instruction for Ireland, Journal*, Vol. XIV, No. 3, pp. 499-506. Dublin, April 1914.

Cheese, properly so-called, ought to be made from whole milk, and should contain as nearly as possible all the fat in the milk from which it was made. Hitherto it has not been easy to condemn cheeses made from skimmed or half-skimmed milk, as there is no standard defining what percentage of fat a whole-milk cheese should contain. To obtain comparable figures suitable for the fixing of a minimum fat content, it is necessary to eliminate the factor water, which varies considerably, even sometimes in cheeses of the same type.

In order to determine what would be a reasonable figure for this standard, the Department of Agriculture and Technical Instruction for Ireland arranged for analyses of Caerphilly and Cheddar cheeses, representing semi-hard and hard cheeses respectively, to be carried out from October 1911 to June 1913 by the Albert Agricultural College, Glasnevin, and the Royal College of Science, Dublin. In each case the test was made with : 1) a sample of the whole milk before manufacture ; 2) a sample of the " green " cheese, and 3) a sample of the " cured " cheese.

The results showed that the percentage of fat in the dry matter never fell below 47. In the case of Cheddar cheeses the maximum and minimum were respectively 53.54 and 48.72 in the green, and 52.96 and 48.60 in the cured. In the case of Caerphilly cheeses the corresponding figures were respectively 56.99 and 47.75 for the green and 57.15 and 47.11 for the cured cheese. The average percentage of fat in the dry matter of all the green cheeses is 51.49, and of the cured cheeses 51.19. The general average for all samples (327) is 51.33. Thus 45 per cent. can be fixed as the limit below which the percentage of fat in the dry matter of a genuine cheese should not fall.

Incidentally, the collected results also show that 1 gallon of milk will yield:

1.300 lb. of green Caerphilly cheese.
1.239 lb. of cured Caerphilly cheese.
1.056 lb. of green Cheddar cheese.
1.000 lb. of cured Cheddar cheese.

950 – **On the Characteristic Flavour of Roquefort Cheese.** — CURRIE, J. N. (Chemist, Dairy Division, Bureau of Animal Industry, U. S. Department of Agriculture) in *Journal of Agricultural Research*, Vol. II, No. 1, pp. 1-14. Washington, April 1914.

These researches were initiated to identify the substances which impart the characteristic Roquefort flavour and to account for their presence. After giving a résumé of the preceding work on this subject, the writer describes his experiments as follows :

1) The experimental method adopted was that employed by JENSEN.

2) *Volatile acids.* — The soluble acids present were essentially a mixture of the volatile fatty acids of milk, *viz.* acetic, butyric, capric, caprylic, caproic. The insoluble constituent contained chiefly capric acid. They may be pre-

sent as free acid or in a feeble state of combination without losing their characteristic flavours. A ripe Roquefort cheese gives a distillation number (*i. e.* the number of cc. of decinormal alkaline solution necessary to neutralise 100 cc. of the distillate) between 30 and 60, whilst a slow-ripening cheese of poor flavour gives a distillation index less than 30, and a quick-maturing cheese of highly developed flavour will have an index above 60, in some extreme cases even exceeding 100.

3) *Relation between volatile acids and flavour.* — The writer is of opinion that the cheese owes its piquant flavour to the accumulation of volatile acids (caproic, caprylic and capric) and their easily hydrolysable salts. These generally occur free, or in such feeble combination that their flavour is not masked.

4) *Origin of the volatile acids.* — Since these acids comprise those found in the fatty matter of milk, from lauric to butyric, and in almost the same proportions, the writer believes these acids are derived from the hydrolysis of the fatty matter of the cheese. The small quantities of acetic and possibly formic acid can be accounted for by the fermentation of carbohydrates in the early period of maturation or by the partial oxidation of higher acids or of glycerine during the ripening period.

5) *Culture experiments with Penicillium Roqueforti.* — Cultures were made in Czapek's solution and by inoculation of sterilized coagulum. In the former case about two-thirds and in the latter about one-half of the fatty matter was hydrolysed without an appreciable accumulation of soluble and volatile acids. In the natural cheese, however, these products accumulate, probably on account of the limited supply of oxygen preventing the complete oxidation of the butyric and caproic acids, or more probably because during maturation, especially in the interior part of the cheese where ripening is more complete, soluble enzymes such as lipase are present.

6) *Enzymes.* — A lipase was extracted from the mycelium of *Penicillium Roqueforti*. It was also shown that the ripening process is promoted by an enzyme capable of hydrolysing simple esters as well as glycerides.

The writer concludes that :

1. During the ripening of Roquefort cheese a considerable quantity of fatty matter is hydrolysed.

2. *Penicillium Roqueforti* produces a lipase soluble in water, which is responsible for the hydrolysis.

3. The hydrolysis causes an accumulation of free or combined fatty acids.

4. The piquant flavour of Roquefort cheese is due to caproic, caprylic and capric acids and their easily hydrolysable salts.

A bibliography of 16 works is appended.

PLANT DISEASES

DISEASES NOT DUE TO PARASITES AND OF UNKNOWN ORIGIN.

951 – **Withering of the Panicle in Rice.** — Poli, Polo, in *Il Giornale di Risicoltura*, Year IV, No. 14, pp. 206-209, 2 figs. Vercelli, July 30 1914.

The phenomenon described as " colatura " consists in a special abortion of the flowers of the apical spikelets of the panicle, which become reduced to whitish filaments more or less shrivelled and twisted, forming a small tuft which disappears before the grain is ripe. This results in a diminution of the yield.

Certain varieties of rice, in particular Italian varieties and those grown for a long time in Italy and thus more susceptible, are more frequently attacked by this disease than the hardier and more resitsant Japanese varieties. Thus, for example, the varieties Ostiglia, Ranghini, Nero di Vialone, and Greppi are conspicuously attacked, whilst Originario is less so.

This disease must not be confused with a very similar phenomenon produced by hail at certain times and in certain conditons of the growth of the plant, namely, when the stem is already swollen and the panicle on the point of appearing from its sheath. Then, if a large hailstone strikes the leaf near the base, it bends back and breaks, thus forming an obstacle to the opening of the sheath, and preventing the regular development of the panicle. This forces a lateral opening and remains caught with the apical grains in the sheath, unable to grow up straight and thereby becoming sterile.

As the result of researches carried out in different seasons, the writer considers the disease is generally due to the coexistence of two principal causes, namely, excessive fertility, and a period of intense cold at the time corresponding to the last phase in the formation of the flowers, when the panicle is still enclosed within the sheath.

BACTERIAL AND FUNGOID DISEASES.

BACTERIA

952 – **The Status of Investigational Work on Pear and Apple Blight.** — SWINGLE, DEANE B., in *Montana Agricultural College Experiment Station, Circular* 39, pp. 13-16. Bozeman, Montana, 1914.

Pear and apple blight is a serious disease which has been observed in the United States (Hudson River Valley) since 1792. J. T. Burrill in 1878 discovered the cause of the disease to be a bacterium called *Bacillus amylovorus*. In 1889 M. B. Waite, of the U. S. Department of Agriculture, observed that some insects convey the bacterium from the partially dead bark bordering on that which is still healthy to the flowers when these begin to open in spring, and thus assist greatly in spreading the disease. Of late years the disease has been studied by several American Experiment Stations from all points of view, as well as the different susceptibility to it of the different kinds of pears and apples, the influence of climate and soil on its virulence and the effcts of the most varied fungicides and insecticides. These researches are being actively continued. The Circular invites practical farmers to have faith in the experimental investigations of phytopathologists and not to allow themselves to be taken in by the vendors of specific remedies consisting of chemicals to be spread on the soil or injected into the trunks of the trees, as the efficacy of such remedies has not been borne out by any rigorously conducted scientific experiment.

FUNGI

953 – **Observations on the Life-History of the American Gooseberry-Mildew (*Sphaerotheca Mors-Uvae*).** — SALMON, E. S., in *The Annals of Applied Biology*, Vol. I, No. 2, pp. 177-182. Cambridge, 1914.

Sphaerotheca mors-uvae (Schwein.) Berk et Curt. differs from other introduced Erysiphaceae in producing abundance of perithecia under normal conditions in Europe. Many of these remain in the patches of mycelium on the shoots until the following spring. According to English legislation fruit growers who do not remove these shoots during the winter are liable to prosecution. The writer suggests the possibility that only perithecia formed during the summer attain maturity; such perithecia germinate easily in contact with a drop of water. On reaching maturity they usually fall to the ground; the perithecia formed later do not hibernate, but always perish, as well as the patches of mycelium, and consequently cannot become sources of infection. It may therefore be necessary to modify the Regulations on compulsory control. It remains now to ascertain how the spring infection takes place. It does not appear that it is always due to the ascospores coming from the ground, because in some cases observed by the writer the first berries infected were the highest; probably many mature perithecia in falling, especially during autumn pruning, get caught in the crevices of the bark or between the bud-scales and there germinate in spring.

954 - **Burgundy Mixture.** — FONZES-DIACON, in *Le Progrès agricole et viticole* (*Edition de l'Est-Centre*), Year 35, No. 29, pp. 70-80. Montpellier, 1914.

MEANS OF PREVENTION AND CONTROL

In this communication presented to the International Congress of Viticulture at Lyons in July 1914, the writer gives an account of his laboratory researches on the composition of neutral, acid and alkaline Burgundy mixture. The superiority of acid sprays (*i.e.* all mixtures containing an excess of copper sulphate), as confirmed by the writer, appears to be due not only to the excess of free copper which they contain, but also to the presence, in solution as well as in the precipitate, of the basic sulphate ($Cu SO_4$, 3 CuO, 4 H_2 O) which is insoluble in pure water but very soluble in presence of dissolved carbon dioxide.

It is also to the presence of this basic sulphate that the mixture owes its property of keeping.

Wetting Burgundy mixtures should belong to the acid type, since alkaline mixtures (*i. e.* those containing an excess of free sodium carbonate) enclose only a little or none at all, of this basic sulphate in their precipitate, and have none in solution.

In the preparation of these acid sprays, the dilute solution of sodium carbonate should be slowly added to the concentrated copper sulphate solution which is stirred constantly.

To obtain an acid spray containing about 200 to 500 gms. of free copper sulphate per hectolitre, about 350 to 500 gms. of 90 per cent. sodium carbonate should be added for each kilo of copper sulphate. The copper sulphate is dissolved in 10 to 15 litres of water and the sodium carbonate in the remaining 85 or 90 l.

955 - **A New *Botrytis* on Flowers of Red Clover in Russia.** — BONDARTSEFF, A. S., in *Xurnal Boliesni Rastenii* (*Journal of Plant Diseases*), Year VIII, No. 1, pp. 1-25, figs. 1-3, plates I-IV (abstract in German). Petrograd, 1914.

BACTERIAL AND FUNGOID DISEASES OF VARIOUS CROPS

The writer has found the flowers of red clover (*Trifolium pratense*) in Russia attacked by a new species of *Botrytis*, which he describes as *B. anthophila*.

The mycelium of the parasite penetrates into all parts of the plant, but is most prominent in the intercellular spaces; it develops its conidia on the anthers. The disease is spread by means of the seed and the writer has observed the mycelium below the seed coat of seeds produced from artificially infected flowers, as well as in those of naturally diseased plants. The presence of the fungus appears to have no effect on the cut of clover. The damage only concerns the anthers and consists in a loss of germinative power of the pollen grains, which appear very deformed under the microscope.

The writer points out that the diseased plants produce a smaller quantity of seed than healthy plants, but the germinating capacity of the seeds produced is higher, being about 63 per cent., whilst that of seeds from healthy plants does not exceed 43 per cent.

In every case the seeds harvested from diseased plants are smaller, shrivelled and less heavy than normal seeds.

The writer considers that seed-testing stations should carry their investi-

gations to the testing of the degree of infection of clover seeds with this fungus, as is already done in the case of cereals infected by smut, *Fusarium*, etc.

In 1913, *B. anthophila* was found in the following provinces: Petrograd, Tula, Kursk, Voronezh, Pskov, Novgorod and Ufa. This would lead one to suppose that the fungus is widely spread and that in case of a bad crop of clover seed the damage is often attributable to this disease alone.

The diseased flowers can sometimes be recognized by their dirty pale violet colour, though flowers with this appearance are not necessarily infected. The disease can easily be recognized by opening the flowers and removing the anthers, which when normal are yellow in colour but when attacked by the disease the conidia of the parasite give them a grey dusty appearance.

956 – **Potato Diseases in Great Britain.** — HORNE, A. S., in *The Annals of Applied Biology*, Vol. 1, No. 2, pp. 183-203, figs 1-8. Cambridge, 1914.

This paper is a critical review of the principal potato diseases which are at present of importance in Great Britain and also of the steps that should be taken to know them better and to control them efficiently. Some of these diseases are treated at length: wart disease or tumour (*Synchytrium endobioticum*), potato disease, late blight or murrain (*Phytophthora infestans*) ; " sprain' ', a disease of the tubers, the origin of which is still obscure, and which includes two forms: " blotch" (internal disease) and " streak" (sprain) ; *Fusarium* disease, under which two types of disease are recognized : *Fusarium* wilt caused by *F. oxysporium*, one of the most serious diseases of the potato in the United States, which does not seem to have appeared in Europe, and the dry-rot disease which appears to be caused by one or more species of *Fusarium* including *F. Solani*, of rare occurrence in Great Britain ; leaf-curl (German " Blattrollkrankheit "), according to the writer not due to parasites ; and lastly canker or powdery scab (*Spongospora Solani*).

957 – **Celery Leaf-Spot Disease (*Septoria Petroselini* var. *Apii*) in England** (1). — CHITTENDEN, F. J., in *The Annals of Applied Biology*, Vol. 1, No. 2, pp. 204-206. Cambridge, 1914.

The seed of celery (*Apium graveolens*) is the chief, if not the only, carrier of the disease caused by *Septoria Petroselini* Desm. var. *Apii* Br. et Cav. The seedlings as soon as they emerge from the ground already carry the fruits of the fungus on the cotyledons and on the plumule ; the disease then remains localized on each plant and does not pass from one to another.

Samples of " seed " — the commercial term for the whole or halved fruits (mericarps) of celery, mixed with other parts of the plant — which were examined by the writer were found to contain 90 per cent. of infected seeds ; consequently it will be advisable to see to the disinfection of the seed and to its collection only from healthy plants.

(1) See also No. 3242, *B.* Nov.-Dec. 1911. (*Ed.*).

958 – **Black Rot of Grapes (*Guignardia Bidwellii*) in Spain.** — RAVAZ, L., in *Le Progrès agricole et viticole*, Year 31, No. 30, pp. 114-115. Montpellier, 1914.

France was formerly the only country in Europe in which the black-rot fungus (*Guignardia Bidwellii* Viala et Ravaz) was known; this fungus has now been reported in Spain. It has not of late years caused as much damage as formerly, probably owing to the absence of the sclerotial stage. Vine leaves and grapes showing the distinctive characters of the disease have been received from the province of Valentia. The fruits were almost entirely destroyed by the disease, thus showing the serious importance of the outbreak.

959 – **A Contribution to our Knowledge of Apple Scab.** — MORRIS, H. E., in *Montana Agricultural College Experiment Station, Bulletin*, No. 96, pp. 69-102, 1 plate + 3 figs. Bozeman, Montana, 1914.

In the State of Montana, apple scab (*Venturia inaequalis*, conidial form *Fusicladium dendriticum*), so common a disease in all portions of the civilized world where the apple is grown, appeared first on the east side of Flathead Lake about 1900 and spread slowly all round.

During the summers of the last three years climatic conditions were favourable for the development of apple scab and the occurrence of twig infection was not at all infrequent, especially on the McIntosh variety. On the shoots the spots caused by the disease are similar to those occurring upon the fruits, except that they are minute, being scarcely visible to the naked eye though readily seen under a low magnification. Living cultures were obtained from some of these spots during the month of March, but no data were secured as to the extent to which such twigs are a source of spring infection.

The primary spring infection period in the State of Montana corresponds to that observed by Wallace, according to whom the spring infection occurs about the time the ascospores mature, if weather conditions at that time are favourable; but during the cool damp seasons of 1911 and 1912 late summer or secondary infection occurred. This took place about the middle of August or beginning of September and at harvest time many minute scab spots were visible on the fruit, which might have been prevented by late spraying.

The observations of the writer, covering a period of several years, confirm the opinion of Wallace that *V. inaequalis* is a species entirely distinct from *V. pirina* (pear scab). He has seen scab abundant on apple trees while Flemish pear trees in the same orchard were not attacked; yet Flemish pear is generally conceded to be very susceptible to scab. In older sections, where both diseases have been prevalent for years, this fact could not be observed.

The injury and corresponding loss to the apple crop due to the presence of scab is far greater than is generally believed; nevertheless it is difficult to value in money the total loss due to the disease. A conservative estimate of the loss due to scab in the Bitter Root Valley during 1911 and 1912 would be 15 per cent. of the entire crop. This loss is due to the reduction in price or to total destruction of the fruit by the fungus.

As there are early blooming varieties of apples and late blooming ones, their proper distribution is important in the control of the disease. When the varieties are badly mixed in rows it is commercially impracticable to spray at the proper time; the difference in time between the blooming of the different varieties necessitates extra sprayings. For this reason it is desirable to set the trees in separate blocks. For equally susceptible varieties which blossom about the same time this would not be so important, but it is never advisable to mix susceptible and resistant varieties. It is well known that there are great differences among the varieties of apples grown in Montana with respect to their susceptibility to scab. The selection and improvement of scab-resistant varieties may be one of the effective methods of dealing with the problem. No variety of apple is immune from scab under the most favourable conditions for the development of the fungus, and it is also recognized that varietal susceptibility may vary in different localities. The opinion of several authors that certain varieties may be resistant in one year and susceptible in another year under conditions which for average varieties are as favourable to the disease in one case as in the other, apparently does not apply to Montana. The writer gives a table in which the 44 varieties of apples commonly grown in the western part of the State are divided into 4 classes (practically resistant, moderately resistant, moderately susceptible, susceptible). It is the result of observations covering a period of five years, three of which were favourable for the development of the apple scab fungus.

The practically resistant varieties are: Hubbardston, Oldenburg (Duchess), Wagener, Wealthy, and York Imperial.

The two fungicides which have been used to a considerable extent in the State are lime-sulphur and Bordeaux mixture; lime-sulphur is the more important and is used generally at a strength which approximates that recommended by Scott (4 lbs. of suphur in solution to 50 gallons of diluted spray). Bordeaux mixture, owing to the russeting of the fruit and burning of the foliage, has been almost entirely replaced by lime-sulphur.

For controlling scab on susceptible varieties — classes 3 and 4 — five applications should be given at specified times; for the fairly resistant varieties — classes 1 and 2 — two sprayings should be given, namely one when the flower buds show a pink colour and the other when most of the petals have fallen; according to weather conditions one later spraying may sometimes be advisable.

According to experiments carried out in Montana on 1200 six-year-old trees, the cost of spraying once with lime-sulphur is 2 cents (1*d*) per tree.

The writer has cultivated the conidial form (*Fusicladium dendriticum*) of *V. inaequalis* in several artificial media with varying success.

The paper concludes with a bibliography referring to 505 works on the subject.

960 – **Rotting of Pomegranates in India: *Sterigmatocystis castanea.*** — BUTLER, E. J., in *The Agricultural Journal of India*, Vol. IX, Part II, pp. 205-206. Calcutta-London, 1914.

Specimens of pomegranates were recently received from a garden in Bombay, which, though of excellent external appearance, were blackened and rotting inside. The rot was found to be due to a fungus, *Sterigmatocystis castanea* Patterson, and the disease to be identical with one described in 1912 as a new and serious disease of this fruit in America, where it had been first observed in the United States in 1910.

In the more advanced stages of the disease there are cavities inside the fruit filled with a brown powdery substance, composed of the spores of the fungus.

It is suggested in the United States that the fungus gains an entry while the calyx is open ; subsequently the calyx closes and the parasite develops within the growing fruit. If this be the case it is hard to see how the disease can be checked. But there is another possibility : several cases are known where fruit which is externally sound is mouldy inside, and in these cases the mould is frequently some common species, whose spores are likely to be present in the air in considerable quantity. Walnuts are, perhaps, the most familiar example of this condition. Tea seed is also not infrequently affected in a similar manner, and very probably the mould gains an entry through punctures in the young fruit caused by a large sucking insect. It is possible that the pomegranate rot is due to a similar cause, and if so, the question of its prevention resolves itself into the question of preserving the young fruit from such insect attacks. The writer proposes, with the co-operation of fruit growers, to ascertain whether this hypothesis has any foundation in fact.

961 – **The Bud-Rot (*Pythium palmivorum*) of Coconut Palms in Malabar** (1). — SHAW, F. J. F., and SUNDERARAMAN, S., in *The Agricultural Journal of India*, Vol. IX, Part II, pp. 111-117, plates IX-XI. Calcutta-London, 1914.

In October 1912 the first report of a serious disease of coconuts in Malabar began to attract attention. The first outbreak noticed was at Tamarasseri ; for several miles round this village, cases of the death of single coconut trees in different gardens were common. In February 1913 the neighbouring localities of Kidavur, Pallipuram, Karothur, Vavada, Poonur, and Puthuppadi were inspected and a number of adult plants and in some cases also young seedlings which had been transplanted only a year before, were found to be more or less diseased. Enquiries made in the locality seemed to show that the disease was of about ten years' standing, but it has spread so slowly that it had not alarmed the growers.

The true cause of the disease was not identified when the first inspection was made, the weather at the time being hot and dry, and it was decided to make further investigations during the rainy season.

For this purpose, Tamarasseri was visited about the end of July at the height of the monsoon, when the nature of the disease at once became

(1) See also *B.* Dec. 1910, pp. 368-370. (*Ed.*).

apparent from a study of young trees in an early stage of infection. The first symptom by which a diseased tree may be recognized is that the central leaf turns brown, collapses and dies. As everyone knows, the youngest central leaf of a coconut is folded up like a fan. If now the dead central leaf be removed and unfolded, it will be found that at the point where the leaf has collapsed the folded lamina is covered with a white fluffy growth of fungus. This fungus, starting at one point of the leaf, eats its way straight through the folds of the lamina and produces a softening of the tissues leading to the collapse of the leaf at this point; as a result of this the portion of the leaf above the point of infection turns brown and dies. In cases in which the infection is very recent and the whole leaf has not had time to turn brown, the area infected by the fungus gives rise to very characteristic rows of spots. If, as sometimes happens, the attack does not spread beyond this point, then when the central leaf expands, a row of brown spots in which the leaf tissue has decayed away can be seen stretching across the leaf.

In material from recently infected leaves it was possible to make a very complete examination of the morphology of the fungus, which left no doubt that it was to be identified with *Pythium palmivorum* Butl., the cause of the bud-rot of palmyras (*Borassus flabellifer*).

On leaf spots, the white fluffy mycelium of the fungus bears abundant sporangia, which under appropriate conditions of moisture discharge their spores. In the case, therefore, of a tree in which the central leaf is attacked it is easy to see how the infection spreads. A single day's rain would be sufficient to wash the spores down from the central leaf into the interstices of the bases of the older leaves, where the fungus would find the most favourable conditions for development. In this way, and sometimes doubtless by infection from other trees, the fungus forms rotten spots on the leaf bases, which vary in size; they are of a dark brown colour and present a fibrous appearance.

Once the fungus has become established in spots on the leaf bases, the death of the palm is a mere matter of time. The mycelium eats its way in, passing from one leaf-base to another, and finally reaches the growing point and kills the tree. As this goes on, the outer leaves gradually droop and fall off, while the spread of the rot is accelerated by various saprophytic fungi, bacteria and insects. In the final stage of the disease the tree is left as a bare pole with, possibly, a single discoloured leaf drooping from the crown. In the later stages of the disease when the outer leaves are falling, it is not easy to identify the fungus; the apex of the palm is then a semi-liquid putrescent mass in which saprophytic organisms are extremely abundant. In the early stages of an infection it might be possible to confuse a case of tree bud-rot with an attack by Rhinoceros beetle (*Oryctes rhinoceros*). However, in those cases of bud rot in which the infection is recent and the whole of the central shoot is not involved, the rows of spots on the folded lamina constitute a reliable criterion of distinction.

From a consideration of the habit of *P. palmivorum* it is not difficult o see how such a disease would spread once it was established in any ne locality. On a windy wet day drops of water containing spores may asily be blown from one tree to another, while the practice of climbing rees for leaf cutting and tapping for toddy would also favour the dissemination of the fungus.

The writers obtained the parasite in pure cultures and were successul in carrying out new infections with them.

At the same time at which this disease was diagnosed at Tamarasseri nd neighbouring localities, it was also identified in other parts of Malabar Malappuram, Melmuri, Calicut, Kurmathur, Andoor, Koyyam, etc.).

At present the disease appears to be scattered throughout Malabar, ut fortunately nowhere with the virulence seen in palmyra palms in ertain localities of the Godavari district.

In both the palmyra and coconut palms it is difficult to recognize the ymptoms of disease in an early stage. This fact, coupled with the difficulty in applying any treatment to palm trees, renders the destruction f infected trees the surest method of controlling the disease. As has been one in the Godavari district, the local authorities are taking active steps or the destruction of the affected trees in the various districts of Malabar, here, more fortunately than in Godavari, it has been possible to diagnose he disease in its initial stage. Since the beginning of operations 352 iseased trees have been identified and of these 150 have already been estroyed.

Among the factors influencing the spread of the disease, that most avourable to the growth of the fungus is the degree of moisture.

62 – **Wood-destroying Fungi which Grow on Both Coniferous and Deciduous Trees in the United States of America and in Europe.** — WEIR, JAMES R., in *Phytopathology*, Vol. 4, No. 4, pp. 271-276. Baltimore, Md., 1914.

In the course of investigations on the fungi attacking forest trees n the North-West States, the writer found many new and exceptional osts for certain fungus species heretofore supposed to be strictly confined o coniferous or deciduous trees. In connection with the facts discovered, here is one which must not be overlooked in the correct determination of imilar species growing under a great range of conditions, namely the reat variation induced in some characters of their sporophores.

The following is a first list of fungi and their new or exceptional hosts.

Hydnum coralloides Scop. (?), abundant on the wood of deciduous trees, specially on *Populus*, has been found in the forests of Idaho and Washington on *Abies grandis* and occasionally on *Picea Engelmanni*.

Stereum hirsutum Willd., frequent in the West on various hardwoods, as been found occasionally on conifers, usually on branches of *Abies randis* and *Tsuga heterophylla*.

S. purpureum Pers., which usually grows on *Populus*, *Salix* and *Betula*, has been collected on moist branches of *Larix occidentalis*.

Hymenochaete tabacina Sid. is common on both conifers and broadeaved trees in the North-West.

Trametes Pini (Brot.) Fr., apparently never reported as growing on deciduous wood, has been collected on *Betula occidentalis* in Idaho.

T. picienus Pk. on *Crataegus* sp. in the West.

T. suaveolens L., common throughout the West on *Populus* and *Salix*, has been found on *Abies grandis*.

Polyporus giganteus (Pers.), described by Murrill as growing on deciduous trees, has been found on conifers in Idaho, more often in connection with old decayed roots of Douglas fir, and on *Pinus sylvestris*.

P. frondosus Fr., known on the roots of Italian chestnuts, and *P. umbellatus* (Pers.), have been frequently observed on conifers in Idaho and Washington.

P. Berkeleyi Fr., found in the East at the base of oaks, has been collected on *Larix occidentalis* in Idaho.

P. picipes Fr., common on *Populus* in Idaho and Washington, has been collected on *Picea Engelmanni* and *Abies grandis*.

P. chioneus Fr., usually found on wood of deciduous trees, is quite common on conifers in the North-West, principally on *Thuya plicata*; it has also been found on *Pinus monticola* and *Tsuga heterophylla*.

P. adustus Fr., common on *Betula occidentalis* and on species of *Populus*, is occasionally found on *Larix occidentalis*, *Thuya plicata* and *Pseudotsuga taxifolia*, though very rarely.

P. dichrous Fr., associated in the East with *Quercus alba*, is common on *Juniperus virginiana* in the vicinity of Washington, D. C., and has recently been found to be a serious sapwood fungus on various North-Western conifers (*Thuya plicata*, *Tsuga heterophylla*, *Pinus monticola* and *Larix occidentalis*).

P. sulphureus Fr., common in Europe on both coniferous and broad-leaved trees, attacks practically every native forest tree in America.

P. caesius Fr., which ordinarily occurs in the East on the wood of deciduous trees, is common in Idaho and Washington on *Tsuga heterophylla*, *Larix occidentalis* and *Abies grandis*.

P. benzoinus (Wahlenb.), common in Idaho and Washington on *Tsuga heterophylla*, *Larix occidentalis* and *Abies grandis*, is undoubtedly the same as *P. resinosus* Schrad., on species of *Populus* and *Acer* in the Eastern States.

P. gilvus Fr., thought to be confined to the wood of deciduous trees, is quite common on *Juniperus virginiana* in the vicinity of Washington, D. C.

Polystictus aurantiacus Pk., considered a very rare fungus in the United States, is principally associated with *Pseudotsuga taxifolia* and *Tsuga heterophylla* in Idaho and Washington; the writer has recently collected it from a maple in Idaho.

P. versicolor (L.) Fr., well known on many deciduous trees, has been collected on *Larix occidentalis*, *Pinus monticola* and *Pseudotsuga taxifolia*.

P. cinnabarinus (Jacq.) Fr., occurring abundantly in the North-West

on *Betula occidentalis*, *Acer glabrum*, *Populus*, *Prunus* and *Salix*, has recently been collected on *Thuya plicata*.

P. hirsutus Fr., one of the most common of all polypores on the wood of deciduous trees, has been collected on *Thuya plicata*.

Fomes pinicola, besides occurring on practically every conifer in the North-West, has been found on *Populus trichocarpa*, *P. tremuloides*, *Betula occidentalis*, *Salix lasiandra*, *Alnus tenuifolia*, *Pyrus Malus* and a variety of plum ; the writer has collected it on *Fagus sylvatica* and *Quercus pedunculata* in Baden, Germany, where it also occurs on *Alnus glutinosa ;* Pennington reports it upon *Fagus ferruginea*, *Betula lenta* and *Acer saccharinum* in the Adirondacks, on the balsam poplars of Northern Michigan and on *Prunus serotina*.

F. annosus Fr., which usually attacks conifers, has been collected on various deciduous trees of the North-West.

F. leucophaeus Mont., frequently found on coniferous hosts in the West, is more often associated with deciduous hosts, especially *Populus*.

Lenzites sepiaria Fr., so common on coniferous wood, is frequently found on deciduous trees, among which Spaulding mentions *Alnus* sp., *Populus alba*, *P. deltoides*, *P. tremuloides*, *Salix* sp. and *S. discolor* ; the fungus has been collected in the North-West on *Alnus tenuifolia*, *Prunus demissa*, *Betula occidentalis*, *Populus trichocarpa*, *Salix lasiandra*, *Acer glabrum* and *Crataegus Douglasii* ; all are very rare hosts, especially the last.

Armillaria mellea (Vahl.) Quél., is common on both coniferous and broad-leaved trees.

Pleurotus serotinus Fr., common on *Alnus* and *Populus*, frequently occurs on *Abies grandis*.

Pholiota adiposa Fr., a serious enemy of *Abies grandis*, occurs also, though rarely, on *Populus*.

Paxillus atrotomentosus Fr., common on coniferous wood, is more rarely found on the wood of broad-leaf species.

PARASITIC AND OTHER INJURIOUS FLOWERING PLANTS.

963 – ***Papaver Rhoeas* and *P. hybridum*, Common Weeds in Egypt.** (1) — BOLLAND, B. G. C., in *The Agricultural Journal of Egypt*, Vol. IV, Part I, pp. 53-54, plate II. Cairo, 1914.

After recalling the general characters of the genus *Papaver*, the writer gives a systematic description of the two commonest species occurring as weeds in Egypt : *P. Rhoeas* and *P. hybridum*.

The former, known in Arabic as " Zaghlil " and " Qarun ", flowers in the winter and spring and is found in waste places and barley fields along the Mediterranean coast.

P. hybridum, in Arabic " Abu el Nôm ", flowers in the spring and is found chiefly in the barley fields of the Mariut district.

(1) See also No. 390, *B.* April 1914. (*Ed.*).

This species was noticed by Forkal in his "Flora Aegyptiaco-Arabica" as growing in Egypt in 1775. The word *Papaver* is also mentioned by Prosper Alpinus in his book "De Plantis Aegypti" written in 1640 (1) but no species is given.

INSECT PESTS.

GENERALITIES

964 – **Notes on the Biology of Leather Jackets (*Tipula oleracea*) in the Pastures of the Avesnois (Nord, France).** — DÉSOIL, P. in *Comptes rendus hebdomadaires des séances de la Société de Biologie*, Vol. LXXVII, No. 21, pp. 126-127. Paris, 1914.

During this year (1914) leather jackets have caused serious damage in the pastures about Avesne (Cantons of Bavay and Le Quesnoy). The farmers in this region noticed scattered throughout their fields numerous circular patches of dead yellow grass which did not resume its normal vegetative growth in April. On digging up these dried patches of turf they were found to be swarming with these grubs, especially on a level with the origin of the roots, the majority with their heads almost level with the surface of the soil, others at a depth of from 4 to 5 inches but within the root range of the grasses.

Grasses and clovers are particularly attacked by these larvae whilst plants with larger and tougher roots, such as couch, dock, plantain, Composites, are free from attack. The larvae in the soil bordering on a trench often fall down and being unable to climb out they become heaped several layers deep. They do not migrate from one plant to another but feed almost entirely on the plant near which their eggs were deposited. After the death of the plant they feed on its dead tissues and decaying humus. They are most injurious during their growing period (October to May), especially to plants which live through the winter. This explains why pasture plants are particularly attacked.

Spring-sown crops are therefore less exposed to attack since they do not possess a well-developed root system until May or June when the larvae are entering on the nymph stage.

According to the writer the only practical means of control is to bury the larvae by deep cultivation at the end of winter and to sow a crop in March or April. Spring-sown oats and wheat have grown without damage on infested land treated in this way.

965 – **Observations and Researches on the Life History of the Beet Aphis (*Aphis euonymi*)** (2). — MALAQUIN, A., and MOIT É, A., in *Comptes rendus hebdomadaires des séances de l'Académie des Sciences*, 1914, First Half-year, Vol. 158, No. 19, pp. 1371-1374. Paris, 1914.

In 1913, M. Gaumont recorded deposits of eggs of sexual females of *Aphis euonymi* Fb. on beets, so that according to him this species is able to

(1) According to P. A. SACCARDO: *Cronologia della Flora italiana*, p. XIII, Padova, 1909, the above mentioned work by Alpino (1553-1617) was published at Padova in 1592.

(2) See also No. 296, *B.* March 1914. (*Ed.*).

complete its life cycle on herbaceous plants. In October 1913 a large number of colonies of this aphis were found on beans and comprised winged males and wingless females ; the latter deposited large numbers of eggs on the stems and leaf-stalks. The observations, accompanied by experiments, were carried on to the spring of 1914.

It was found that eggs deposited by sexual females on beans (intermediate host) in the autumn did not hatch, whilst eggs deposited on the principal host, *Euonymus europaeus*, hatched out normally. Further, when the larvae from these eggs were placed on beet leaves, they refused to attack them.

It appears therefore that in the case of a migratory species such as *A. euonymi*, the generation produced from the fertilised eggs is adapted only to the conditions of its principal host, and the adaptation to different food (intermediate hosts) appears in later generations.

966 – **The Emergence from the Soil of the First Larvae of *Phylloxera vastatrix* in Italy.** — GRASSI, B., in *Rendiconti delle sedute della Reale Accademia dei Lincei, Classe di Scienze fisiche, matematiche e naturali*, 2nd Half-year, Vol. XXIII, Part 2, pp. 19-30. Rome, 1914.

Researches carried out in North, Central and South Italy show that the emergence of the first larvae from the soil before they commence to feed is a normal phenomenon of more general occurrence than was believed by Faucon, who first observed it (1868), and the other authorities who have recorded it. A close examination with the naked eye or a hand lens of loose soil close to diseased stocks is sufficient to reveal their presence.

The emergence of the larvae is more or less abundant throughout the year, except during the hibernation and the period preceding the birth of the first daughter generation of the hibernating females. In Southern Italy they do not appear so frequently from the second half of July to the end of August, the period corresponding with the partial aestivation of the insect.

Considering such a powerful means of distribution of the insect as these first larvae, it is reasonable to suspect that the passing of workmen to and fro in the vineyards is a source of danger. This fact should be taken into account before adopting measures for controlling the disease, when an old centre of infection has been discovered and especially when there is reason to believe that the whole vineyard has become infected.

Researches are being conducted to determine the influence of tillage, the presence or absence of superficial roots, of root development, etc., on the numbers of these first larvae which emerge from the soil. It has already been determined that winter digging is a most effective means of propagating phylloxera over both small and large distances.

It is also affirmed that it is dangerous to examine for phylloxera during windy weather, since a slight wind suffices to carry the larvae from the exposed roots. The necessary precautions to prevent these dangers are too often neglected by the workmen.

967 – **Notes on *Aspidiotus bromeliae*.** — LINDINGER, LEONHARD, and GREEN, E. ERNEST, in *The Journal of Economic Biology*, Vol. 9, No. 2, pp. 73-75. London, 1914.

Contrary to the opinion of Green (1), Lindinger affirms that *Aspidiotus bromeliae* is indigenous to the Azores and not the Canaries. He also adds that as this scale attacks only Bromeliaceae, its original country should be sought in America where these plants (including the pineapple) are indigenous. He also disagrees with Green that this insect may become a serious pest of the pineapple, as its development is too slow.

Green replies that our knowledge of this species is too incomplete to make definite conclusions, since it is not yet known if it is confined to the Bromeliaceae. Further, the Bromeliaceae are indigenous not only to America but also to India, Ceylon, Java and other eastern countries. As to the danger of these scales, Green mentions that the pineapple material from the Seychelles was so badly infested that the health of the plants must have been seriously affected. The rapidity of development of these insects depends so much on the presence or absence of their natural enemies (Coccinellids and Hymenopterous insects) that conclusions based on conditions prevailing in one region may be completely upset by conditions in another region.

968 – **On the Reproduction and Fertility of the Elm Leaf-Beetle (*Galerucella luteola*).** — LÉCAILLON, in *Comptes rendus hebdomadaires des séances de l'Académie des Sciences*, 1914, 2nd Half-year, Vol. 159, No. 1, pp. 116-119. Paris, 1914.

The elm leaf-beetle (*Galerucella luteola*) belongs to the Chrysomelidae and occurs in Europe, Algeria and in the United States. Both larvae and adults feed on the leaves of the elm (*Ulmus campestris*), often causing considerable damage to trees in parks and public places. Sometimes the insect is so numerous that only the veins and petioles of the leaves remain, and when this happens several years in succession the life of the trees is endangered.

The extraordinary abundance of this insect cannot yet be attributed to the occurrence of two generations in one year, but the writer has observed this year on trees near Toulouse and on laboratory specimens that the period of reproduction extends from the beginning of May until early July. The number of eggs in each cluster on the lower surface of the leaf is very variable ; the number laid by one female is much greater than was formerly believed, some females reared in captivity having deposited more than 500 eggs. During the period of reproduction the males and females feed abundantly. In the open the females do not lay all their eggs on the same leaf, or even on the same tree. Further, the larvae from one egg-cluster move to different leaves on reaching a certain size.

(1) See No. 798, *B.* Aug. 1914. (*Ed.*).

69 – **Winter Precautions against the Pupae of Vine Moths (*Conchylis ambiguella* and *Polychrosis botrana*) in Piedmont** (1). — TOPI, M., in *Rendiconti delle sedute della Reale Accademia dei Lincei, Classe di Scienze fisiche, matematiche e naturali*, 1914, 1st Half-year, Vol. XXIII, Part 12, pp. 981-984. Rome, 1914.

The writer gives an account of his observations and researches on he control of the hibernating pupae of *Conchylis ambiguella* and *Polychrosis botrana*, carried out on several occasions in the Upper Monferrato territory of Alice Bel Colle), Piedmont, partly in collaboration with F. Monticelli.

The canes generally used for supporting the vines often have the op internode open, thus providing suitable shelters for the larvae seeking places for pupation. For this reason the tipping of the canes and destruction of the tips is recommended, in addition to the stripping of the stocks, which is a laborious operation not without danger.

To determine the value of this tipping, it was necessary to know to what extent the larvae use the tips of the canes for pupation. In a badly attacked vineyard, 25 vines were stripped during the winter and the tips of the canes were examined: the result was 19 pupae in the canes and 8 under the bark. If this is a general proportion, tipping would prevent he emergence of about half the moths, which is not a sufficiently large proportion for a good control; further, the method is laborious.

Better results can be obtained by using artificial shelters, among which the most successful are those described and used by G. Cantoni, in the Trentino. The method consists in placing cloth bands at the base of the shoots on the two-year-old wood; the larvae pupate in these and can be easily destroyed. Where canes are used as supports, they should be tipped, and the bands may be placed on them as well as on the stocks. In a comparative experiment it was found that in this case the stocks were as much used by the hibernating larvae as the canes, or even more so.

These measures can be made more effective if the bands containing he pupae are placed in special cages to allow the escape of any Hymenopterous parasites that may be present, but not the moths. Out of 100 cocoons, 57 moths and 22 Hymenopterous parasites were obtained; the rest of the pupae were attacked by fungi and a few cocoons were empty. If they had been in the open, a certain number of pupae would no doubt have been destroyed by animals, fungi and other causes. Frequently a species of *Helops* and the larvae of *Malachius bipustulatus* are found in the ends of the canes, and though they are believed to prey on the pupae, their usefulness and voracity must be considered highly doubtful.

The writer remarks on the preponderance of *Polychrosis*, since out of the 57 moths mentioned above, 54 were *Polychrosis* and only 3 *Conchylis*. In the catch of molasses traps the number of *Conchylis* was appreciably larger, namely 10 to 73 *Polychrosis*; possibly *Conchylis* was abundant locally in the district in which these researches were made.

(1) See also No. 590, *B.* June 1914. (*Ed.*).

970 – **The Fumigation of Citrus Trees in Egypt.** — GOUGH, LEWIS, in *The Agricultural Journal of Egypt*, Vol. IV, Part I, pp. 17-19. Cairo, 1914.

After having mentioned that citrus trees in Egypt are subject to the attacks of several species of scale insects (1) among which the most important are *Aspidiotus aonidum* (?), *A. aurantii* and *Icerya purchasi*, Dr. Gough describes the system of control which has been adopted and which is carried out only by the Government and which consists in the well known process of fumigation with hydrocyanic acid.

INSECTS INJURIOUS TO VARIOUS CROPS

971 – **The Principal Pests of Rice in Indo-China.** — DUPONT, L., in *Journal d'Agriculture tropicale* Year 14, No. 157, pp. 204-207. Paris, 1914.

I. INSECTS. — The writer gives some information on the following insects injurious to the rice crop.

a) Lepidoptera. — 1) *Sesamia inferens* Wlk., the young larvae of which enter the upper portion of the stem and bore their way to the base, where they frequently pupate; the pupae are easily destroyed in great numbers by raising the level of the irrigation water so that they become submerged. A certain number of larvae, however, always ascend the stem to pupate. As many as ten pupae have been found in one stem. This species, already recorded in India, Java, Tonking, etc., caused great damage to the rice crop in the state of Pahang (Federated Malay States) in 1906.

2) *Schoenobius bipunctiferus* Wlk., the larva of which, on leaving the stem, protects itself with a fragment of the leaf until it returns to pupate at the base of the stem; the moth emerges after 10 or 15 days. It has caused great damage in the Philippines and occurs in Java, Tonking, etc.

3) *Cnaphalocrocis medinalis* Gn., is the commonest padi borer; after boring the upper portion of the stem, it gradually works its way to the base. Its presence is indicated by an empty panicle of a blanched appearance, later turning ashy grey or dark grey on the development of saprophytic fungi. The damage due to this insect may vary from 5 to 25 per cent. It is kept in check by cutting the diseased stems as low as possible, soon after the appearance of the panicles, and destroying them without delay, or by ploughing in the stubble immediately after harvest. This species has been recorded in India, Java, and Tonking.

4) *Artona walkeri* Moore; this seems to be the first record of this species as parasitic on rice; in 1911 it caused considerable damage in the province of Thaï-Nguyen, and it was recorded in the neighbourhood of Hanoi in 1913.

5) *Sitotroga cerealella* Oliv.

b) Hemiptera. — 1) *Leptocorisa varicornis* Fabr. is widely distributed at all seasons of the year. It sucks the milky contents of the young grains. When they occur in large numbers they may be kept in check by sweeping with nets of fairly large mesh. It is also useful to destroy the grasses

(1) See No. 1485, *B.* Oct. 1912. (*Ed.*)

which grow in the neighbourhood of rice fields. *Cicindela sexpunctata* is a very effective and abundant natural enemy of this pest in Tonking.

2) *L. acuta* Thumb., which causes similar damage, is widely spread in the Philippines ; in 1909 it caused serious damage to the rice fields in Ceylon.

II. Fungi. — Finally the writer mentions two fungi : *Ustiliginoidea virens* Tak. and *Tilletia horrida* Tak. (1).

The former, restricted to rice, is common in Tonking, the ten-months' rice being most particularly attacked. Near Hanoi as many as 15 diseased grains have been found on one panicle by the writer. It is most abundant in rice fields which are badly cultivated. The infested grain swells and assumes a yellowish-green colour more or less intense according to the development of the disease ; it soon becomes a dull green velvety mass covered with spores, from 6 to 10 mm. in size and darkening in colour until almost black, whilst its surface disintegrates and falls to dust : beneath the greenish-black dusty layer of spores there remains a small very hard, orange-yellow mass with a hard white centre. The fungus is common in Japan, China, etc.

Tilletia horrida also attacks the grains in the panicle, converting them into a black powdery mass of spores. The writer has observed it on ten-months' rice near Hanoi and in the province of Phu-Yen. It is much rarer than *U. virens*.

972 – **The Mole Cricket (*Gryllotalpa vulgaris*) damaging Rice Fields in Italy.** — Novelli, N., in *Il Giornale di Risicoltura*, Year IV, No 13, pp. 189-193. Vercelli, July 15, 1914.

The writer records that the mole cricket occurs in increasing numbers in certain irrigated rice-growing districts in Italy, where the conditions are undoubtedly very favourable to its development.

It causes considerable damage and the writer has seen entire fields almost devastated by the insect. Wheat, oats and barley have been badly thinned and maize reduced so as to require re-seeding. Where the crops were drilled the damage was worse, since the crickets follow along the lines more easily. Close to the banks dividing the rice plots in the previous year, the damage is always complete; wheat or maize following grass is always greatly thinned and market garden crops are very seriously damaged. Dry land rice is attacked similarly to wheat ; and in ordinary cultivation they come down from the banks to devour the rice when the water is run off, especially at the first drying. The banks often become so infested by these insects that their resistance to water becomes seriously impaired, the escaping water giving rise to so-called cold spots below, where the rice remains stunted.

The writer points out the importance of adopting measures against this pest without delay and recommends the following : *a*) summer cultivation in the irrigated regions, so as to interfere with the development of the insect, and destruction of the nests by children or labourers following

(*Ed.*).

(1) See No. 992, *B.* March 1911.

the plough: stamping on them is sufficient to destroy the eggs or young larvae; *b*) early ploughing of the leys intended for wheat, maize, etc., followed by a second ploughing before sowing; *c*) searching for the insects during the irrigation of the fields: as the water rises they leave their burrows and collect on the higher grouud, many swimming to the banks, where they can easily be destroyed; *d*) searching for the insects and their nests in the banks, or injection of carbon di-sulphide in holes 8 inches or more deep and 30 inches apart, or watering the banks with 20 per cent. petroleum emulsion: any insects which come out on the surface as a result of these treatments can easily be destroyed under the feet.

973 – **Sweet Potato Sphinx (*Herse convolvuli ?*) in Natal.** — FAURE, J. C., in *The Agricultural Journal of the Union of South Africa*, Vol. VII, No. 4, pp. 515-519, fig. 1. Pretoria, 1914.

The sweet-potato industry in the New Hanover-Dalton District in Natal has increased rapidly in recent years. There are probably about 2000 acres under sweet potatoes every year, and the gross value of the crop is about £20 000.

In November 1913 reports from the district came in about severe injury to the crop caused by a larva which the writer refers doubtfully to *Herse convolvuli* L. It devours the leaves of the sweet potatoes, causing a loss which is estimated at from 25 to 50 per cent. and even more. One 17-acre field was severely infested and the whole of it was practically defoliated in the course of a week.

Growers are of opinion that there are three occurrences of the larvae every season, one towards the end of November, one in January and another in March. The January infestation seems to be that most feared. At Schroeders in Natal the insect has been known for the past twentyyears.

The writer gives the following information on the life-history of the sphinx: the eggs are laid singly on the under sides of the leaves: the larvae show a great variation in colour and markings, the majority, however, being dark brown; pupation takes place in the soil.

From dead larvae Tachinid flies have been reared, as well as a small Chalcid which might be a hyperparasite.

The experiments carried on at Schroeders on a small scale indicate that the sphinx can be readily controlled by the use of arsenical sprays. Paris green gave the best results, but arsenate of lead will probably also answer the same purpose. The former was used at the rate of 1 lb. to 2 lbs. of lime and 75 gallons of water, and arsenate of lead at the rate of 3 lbs. to 50 gallons. The mixtures were sweetened in both cases. From 30 to 80 per cent. of the larvae were thus killed and besides this the sprayed areas were markedly avoided by migrating larvae. Hand-picking will probably be very successful on a small scale, and since the insect hibernates in all probability as a pupa in the soil, thorough winter ploughing and harrowing may destroy many of the pupae and thus aid in the control of the pest. During their migrations the caterpillars might be killed by digging ditches for them to collect in or by the use of poison bait spread across their line of march.

974 – **Large Narcissus Fly (*Merodon equestris*) and Small Narcissus Fly (*Eumerus strigatus*) Injurious to Bulbs in Great Britain and Ireland.** — *Board of Agriculture and Fisheries, Leaflet*, No. 286, pp. 1-7, 1 plate. London, 1914.

Of the various animal pests attacking the bulbs of Narcissi and related plants, none are more injurious than the two Narcissus flies, *Merodon equestris* F. and *Eumerus strigatus* Flu. The former, often known as the Large Narcissus Fly has been known in England since 1869, and is now widely distributed in England and Wales, while it also occurs in many parts of Scotland and in Ireland. It is generally supposed to have been brought to England, probably from Holland, but in the opinion of others it is considered to be native.

The systematic description of the insect is given in the leaflet together with its life history.

The bulbs attacked include the Narcissus, Hyacinth, Tulips (rarely), Amaryllis, Habranthus, Vallota, Galtonia, Scylla and Leucojum. As regards Narcissus, it has been observed that the hard bulbs of the *N. maximus* and *N. spurius* type are least attacked, while the most susceptible are the *N. poeticus* and *N. Lecdsii* varieties, and, further, that varieties with coloured cups are more susceptible than those without.

The interior of the bulbs is hollowed out, a wet mass of frass and decayed matter only remaining. The decay due to *Merodon*, however, does not cause such a complete breakdown of the bulb as in the case of an attack by *Eumerus*.

When the larvae are large the infested bulbs can be detected by gently pressing near the neck with the fingers : sound bulbs being hard, and infested ones less resistant. When the larvae are young, it is much more difficult to be sure of their presence, but it is said that any bulb in which the basal ring is incomplete or damaged should be regarded with suspicion.

When a number of bulbs in a row fail to appear in the spring, those which have missed should be searched for and destroyed. Bulbs should be lifted in summer and all found to be infected should be destroyed. Bulbs may be steeped in water for from 24 to 48 hours. The water should be just warm, and if possible should not be allowed to become very cold in order not to injure the bulbs. The steeping seems to make the bulbs swell, so that the larvae are forced out or drowned, though they can live for many days when immersed. This treatment has been found very effective. Netting the flies with a butterfly net has been found quite successful in gardens.

The Small Narcissus Fly (*Eumerus strigatus*) has been only recently recognized as seriously injurious to Narcissi ; it attacks also Hyacinths, Onions and Shallots (the two latter only on the Continent).

The systematic description of this insect, as well as its life-history, which has not yet been completely traced, are given in the leaflet.

In an advanced stage of the attack the interior of the bulb is entirely destroyed and is full of a semi-liquid decaying mass. The attack seems to begin at the neck, and in mild cases the larvae are found in the neck or under the scales at one side. The presence of many larvae and the complete

decay produced distinguish the damage done by *Eumerus* from that done by *Merodon*.

The destruction of affected bulbs when lifting is obviously indicated, and since the decay produced is rapid there is little difficulty in recognizing them. Early lifting also seems desirable to destroy the larvae before the emergence of the second brood.

The larvae of several other flies are frequently found in bulbs decaying from other causes, but they do not appear ever to start an attack on a healthy bulb. The commonest species are *Lonchaea chorea* and species of *Scatopse* and *Sciara*.

ALFREDO RUGGERI, gerente responsabile.

FIRST PART.

ORIGINAL ARTICLES

The Grass and Clover Seed Industry in New Zealand

by

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New Zealand Agriculture is not conspicuous for harvested crops. The area devoted to them is insignificant when compared with that utilized for grazing or feeding-off by stock. During the season 1913-14 less than eight hundred thousand acres out of a total of forty odd million acres that are under occupation were utilized for the production of all kinds of harveted produce, including hay. Less than one per cent of the sown grasslands are annually cut for hay, and this gives a very clear indication of the small provision that need be made in New Zealand for the production of stored winter feed. As, compartively speaking, no exportation of cereals takes place, the reason for the minor position of annually harvested crops is readily explained. Of the 800 000 acres employed in their production, over 100 000, or more than 12 per cent., were devoted to grass and clover seed. Thus the growing of "pasture seeds" occupies quite an important position amongst the minor agricultural industries; in point of view of both acreage and value of production, pasture seed raising ranks third in importance (after oats and wheat) and far exceeds in value the hay crop.

Although New Zealand is eminently adapted for the successful production of all kinds of pasture seeds a large quantity is annually imported. This is due to the fact that the utilization of land purely for growing pasture seeds is rarely attempted, and unless the growing of a comparatively pure crop of any grass or clover will fulfil other functions besides that of producing a seed crop its cultivation is not entertained. The only grasses that are grown on any extended scale purely for seed production are

Crested Dogstail and Western Wolths Ryegrass; in nearly overy other case the primary object in the laying down of grassland is the securing of either temporary or permanent pasturage. Whether or not the grassland will be shut up for seed depends on the market prospects and whether the farmer intends to stock the whole of his grazing area fully during the summer. The profit to be made by temporary fattening is in most cases the deciding factor. Thus grass and clover seed raising can in New Zealand be looked upon as really a bye-product of pasture land made use of when it appears to be more profitable to let the seed mature than to feed off the growing herbage with grazing animals for the elaboration of mutton, beef or butter fat. It would thus be surmised that the main pasture seeds produced in the Dominion would be those that comprise the dominant elements of the ordinary pastures. This surmise would be quite correct: the two main grass seeds produced are those of Ryegrass and Cocksfoot, which represent the two main grasses used in pasture formation and which form the dominating elements in the majority of the sown grasslands of New Zealand.

The demand for "pasture seeds" in New Zealand is large and probably no other country in the world uses a larger variety in the laying down of permanent pastures. The formation of permanent pasture is one of the most important features of New Zealand agriculture. There is no natural grassland that in any way corresponds with true pasture and the grasslands of New Zealand can be sharply divided into two classes: the natural grasslands and the sown grasslands. The former are characterized by the dominance of tall, densely tufted tussock grasses, belonging to the genera *Poa* and *Festuca*, growing at more or less regular intervals from one another and never making a compact sward capable of being mown. The sown grasslands are characterized by consisting almost entirely of European pasture grasses belonging mainly to the genera *Dactylis*, *Lolium*, *Festuca*, *Agrostis* and *Holcus*, and forming in most cases a uniform sward kept closely cropped by grazing animals. The sown grasslands comprise some 17 million acres, of which about four million consist of leys with a duration of from 2 to 7 years, the remainder being permanent pasture. Each year about one million acres are sown down in temporary and permanent pasture, the area in the latter being steadily increased through the conversion of native vegetation, mainly forest, into grassland. As roughly over 25 pounds of seed is used per acre, the annual consumption of pasture seeds is roughly about 12 000 tons.

Although a very large variety of grasses and clovers are sown in New Zealand, only a few are grown for seed purposes in sufficient quantities to satisfy the local demand. These are the following:

1. Perennial Ryegrass (*Lolium perenne*).
2. Italian Ryegrass (*Lolium italicum*).
3. Cocksfoot (*Dactylis glomerata*).
4. Chewing's Fescue (*Festuca saburicola*).
5. Danthonia (*D. pilosa* and *D. semiannularis*).
6. Ratstail (*Sporobolus indicus*).

7. Prairie grass (*Bromus unioloides*).
8. Reed Fescue (*Festuca arundinacea*).
9. Yorkshire Fog (*Holcus lanatus*).
10. Suckling Clover (*Trifolium minus*).
11. Boyd's Clover (*Lotus angustissimus*).
12. Lucerne (*Medicago sativa*).

The following are regularly produced, but in insufficient quantity to cater fully for the local demand :

1. Crested Dogstail (*Cynosurus cristatus*).
2. Meadow Foxtail (*Alopecurus pratensis*).
3. Red Clover (*Trifolium pratense*).
4. White Clover (*Trifolium repens*).
5. Birdsfoot Trefoil (*Lotus uliginosus*).
6. Western Wolths Ryegrass (*Lolium italicum* var.).

Grasses and clovers that are regularly used in the laying down of pasture but which are rarely harvested in any appreciable amounts are the following :

1. Kentucky blue grass (*Poa pratensis*).
2. *Poa trivialis*.
3. Timothy (*Phleum pratense*).
4. Sheeps Fescue (*Festuca ovina*).
5. Red Fescue (*Festuca rubra*).
6. Hard Fescue (*Festuca duriuscula*).
7. Meadow Fescue (*Festuca pratensis*).
8. Fiorin (*Agrostis alba*).
9. Red Top (*Agrostis vulgaris*).
10. Brown Top (*Agrostis canina*).
11. Paspalum (*Paspalum dilatatum*).
12. Alsyke (*Trifolium hybridum*).
13. Trefoil (*Medicago lupulina*).

It will be noted that nearly all the recognised pasture grasses of Europe are made use of, with the notable exception of Tall Oat Grass (*Arrhenatherum elatius*) ; although fairly widely naturalized, it is not used in New Zealand agriculture.

The main Pasture Seeds harvested.

Perennial Ryegrass. — About 50 000 acres are annually cut for seed. The majority is harvested from pastures of short duration, although a proportion is procured from permanent pastures. In many parts, notably on the east coast of the South Island, it is a regular practice to crop land for a season or two with annual crops and then lay it down in Ryegrass, White and Red Clover ; it then remains in pasture until such time as the land is again required for cropping and during this period several crops of seed may be taken off. The permanent pastures of Ryegrass are mostly found in the North Island and if not required for fattening purposes a seed crop is harvested in certain cases annually. In most cases stock are exclu-

ded for about three months of the year, but in certain instances the land may be lightly stocked even after it has been decided to harvest a seed crop. The crop is generally cut with a reaper and binder, but a stripper may be occasionally employed. The yield varies from 400 to 600 pounds per acre. The land from which the seed is harvested is ordinary pasture in which Ryegrass, although dominant, is only one of the elements of the association; as no cultural methods are adopted the harvested product contains a large proportion of seeds other than Ryegrass. Thus the cleaning of the harvested seed is a very important matter and in some instances a loss of over 50 per cent. by wieght is experienced in the dressing, although as a rule 25 per cent. may be looked upon as the average. The cleaning is done by power machines; in most cases rotary riddles of varying mesh are employed for removal of the extraneous seeds, and winnowing is also utilized for the extraction of light seed. The bushel weight varies from 26 to 36 lbs. and 30 lbs. is looked upon as the minimum bushel weight of first-class machine-dressed seed. The germination of high grade seed is over 90 per cent., and 75 per cent. is the average of all lines. The total crop sometimes exceeds 8 000 tons of dressed seed, and nearly the whole of this is used locally, only a cemparatively small quantity being exported and that mainly to Australia.

It is difficult to determine the amount of *Italian Ryegras* produced, as there are no separate figures for this crop, but 1 000 tons would be a moderate estimate. The yield of Italian is on the whole higher than that of Perennial Ryegrass, and the bushel weight is rarely more than 23 pounds. In most cases the purity of machine-dressed seed is low, owing to the large amount of Perennial Ryegrass that is generally present in the pastures from which the seed is harvested.

Cocksfoot. — An average of 30 000 acres is annually harvested. The main quantity of seed is produced on steep hillsides on Banks Peninsula in the South Island and is termed "Akaroa" Cocksfoot. Cocksfoot is also harvested by machines from level pastures of Cocksfoot and Ryegrass, when it is termed "Plains Cocksfoot", and even after machine dressing may contain as much as 30 per cent. of Ryegrass. All the hillside Cocksfoot is cut and threshed by hand labour and each man is paid from 1*s* 3*d* to 1*s* 6*d* per hour. The bushel weight of machine-dressed seed varies from 14 to 20 pounds, 16 lbs. being looked upon as the standard. The average yield is about 160 lbs. per acre and the loss in cleaning averages 20 per cent. Machine-dressed seed of 16 pounds bushel weight generally contains less than 3 per cent. of extraneous seeds (consisting mainly of *Holcus lanatus* and *Hypochaeris radicata*) and about 10 per cent. of empty and semi-empty husks. The germination of the *pure* seed averages about 84 per cent. The annual crop occasionally exceeds 2 000 tons of dressed seed. A considerable amount of Cocksfoot is exported to Europe, and for years New Zealand seed was looked upon as superior to that from any other country at the present time, however, Danish seed is looked upon with more favour than formerly, and threatens to supersede New Zealand on the European markets unless our local seed is cleaned to a higher standard than is a

present adopted. The price of labour is now so high in New Zealand that the margin between the cost of the undressed seed and the average price for dressed seed in Europe is too small to allow of any more loss in cleaning than is now experienced.

Chewing's Fescue (*Festuca saburicola*). — About 6 000 acres are annually harvested in the southern portion of the South Island. The yield averages about 400 lbs. per acre. As Chewing's Fescue forms one of the purest of the New Zealand pasture associations, the amount of extraneous seeds is not great even in undressed samples, but seed of this fescue, like many other species of the genus, contains a large percentage of empty husks, and thus the loss in cleaning is often very great. A large proportion of the seed is exported to Europe where it is sold under the name of New Zealand Red Fescue. The germination is generally high and when harvested under good conditions averages over 85 per cent.

Pasture Seeds Harvested in Small Quantities.

Besides the four grasses mentioned, a number of others are harvested in limited quantities. The most important of these is *Crested Dogstail*, which is occasionally produced in sufficient amount to more than satisfy the annual local demand of about 150 tons.

Clovers are not extensively harvested and roughly about 3 000 acres are cut for seed. The most important is *Red Clover*, nearly always sold under the name of Cowgrass, but the quantity produced is never sufficient for local requirements. The large number of species that are regularly sown but not grown for seed is peculiar, but is explained by the fact that none of them normally occupy a dominant position in any type of pasture, although the majority are generally distributed throughout the majority of our sown grazing land. Wherever a pasture consists mainly of a single species it may be shut up and harvested for seed ; thus in certain instances such grasses as Meadow Foxtail, Danthonia, Prairie grass and Reed Fescue may be harvested in quite large amounts. In very few instances, however, is the pasture laid down with the express inteution of utilizing it for seed production, but the conditions being favourable for the final development of a comparatively pure association of a single species the production of a seed crop of that particular species becomes profitable and this practice is then adopted.

Seed Cleaning.

There are two systems in vogue with regard to the cleaning of grass and clover seed. In the first one the merchant pays so much per pound to the farmer for his seed in the rough, *i. e.* uncleaned. In the other the merchant pays a certain price for the seed after it has been dressed and brought up to a specified purity and bushel weight. When seed is bought in the rough the merchant puts it through the cleaner, of which he is generally the owner, and utilizes any bye-products that may result. When the merchant buys machine-dressed seed the farmer has to pay for the

cleaning and is credited with the value of any bye-products that are of any commercial value. The price paid for cleaning varies with the kind of seed that is being dealt with. Ryegrass generally costs 3*d* for every 20 pounds put through the machine, and Cocksfoot and Chewing's Fescue about ¼*d* per pound, while Crested Dogstail generally averages about ½ *d* per pound. The price charged for clover cleaning varies according to the purity to which it has to be dressed, but ½ *d* per pound is about the average price in vogue.

The large amount of impurities that are general in New Zealand harvested grasses and clovers, due to the utilization of ordinary mixed pasture for their production, has necessitated the invention of many mechanical devices in order to produce a clean line. The majority of the seed-cleaning machines in use are manufactured locally and have been specially designed to suit local requirements.

Bye-products of Seed Cleaning.

The main object of seed cleaning in New Zealand is the more or less total removal of all extraneous seeds. It is not unusual for many lines to contain large quantities of extraneous seeds that have a commercial value and many of the cleanings are re-cleaned and sold. In many instances the value of the bye-products of the machine cleaning are sufficient to cover the cost of dressing the original seed, and in certain instances the bye-product may be more valuable than the seed that is being dealt with. The main grass and clover seeds of commercial value found in cleanings are as follows:

1) Yorkshire Fog (*Holcus lanatus*). — A bye-product of most grass seeds in New Zealand. Although Yorshire Fog is only intentionally sown in certain situations, it is a regular constituent of nearly all pastures. The covering glumes are always removed in the cleaning process and the re-cleaned article is quoted as " shelled Fog ". The majority of the seed is exported to Europe and Australia.

2) Suckling Clover (*Trifolium minus*). — Like Yorkshire Fog, Suckling Clover is a regular constituent in all pastures although it is rarely intentionally sown. The seed is all exported to Europe and is most probably used as an adulterant in White Clover. It is significant in this respect that the brighter the sample the more readily will it sell, while dark coloured lines, even though the germination and purity may be excellent, are comparatively unsaleable.

3) White Clover (*Trifolium repens*). — White Clover is frequent in undressed Ryegrass seed and whenever it occurs in appreciable quantities is re-cleaned. It is generally of excellent quality and is often used to mix with imported lines to improve the colour. In certain instances undressed Ryegrass may contain as much as 25 per cent. of White Clover.

The major portion of the cleanings from New Zealand seed consist of Sorrel (*Rumex Acetosella*), Goosegrass (*Bromus hordeaceus*), Catsear (*Hypochoeris radicata*) and Sweet Vernal (*Anthoxanthum odoratum*), while

during certain seasons large amounts of Ergot sclerotia are removed from Ryegrass. None of these have any commercial value, although at times certain of the cleanings are ground up and incorporated into stock feeds. In general, however, the majority of the cleanings are burnt.

Adulteration of Seed.

Comparatively no adulteration of pasture seeds occurs in New Zealand. In certain instances Chewing's Fescue (*Festuca saburicola*) may be sold under the name of Sheep's Fescue (*Festuca ovina*) and occasionally Suckling Clover (*Trifolium minus*) is added to lines of White Clover. Formerly Cocksfoot was sometimes adulterated with either Ryegrass or Chewing's Fescue, but this practice is now rare. The mixing of different grades of the same species is, however, not uncommon. This refers more particularly to Ryegrass, where a low and a high germinating line may be mixed together in about equal amounts. There are many lines of New Zealand grown grasses on the market that contain a very large percentage of extraneous seeds, but these are in no case examples of adulteration. They simply represent seed that has not been properly dressed and has been harvested from mixed pasture in which a single species, although the dominant element of the association, may not occupy more than 70 per cent. of the ground. Ordinary machine-dressed seed, with the exception of Italian Ryegrass, however, is nearly always of high purity so far as freedom from extraneous seeds is concerned. Seed cleaning has in New Zealand been raised to a fine art and the standard set by seed cleaners is so high that so far as purity is concerned, machine-dressed local seed compares more than favourably with that imported.

The Present Condition of Forestry in Hungary

by

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Royal Counsellor for Forests and Waters.

Forest Legislation. — The forest law XXXI, of 1879, marks an important point in the history of Hungarian forest economy. This law, made necessary by the devastation and progressive diminution of the forests between 1850 and 1870, gave wide powers to the State, though at the same time respecting the rights of private property. After the abolition of servitudes and the development of small freeholds, large extents of forest fell into the hands of peasants who knew little about their management, and either cleared them for cultivation or ruined them by excessive grazing. At the same time the economic development which started in 1870 and the improvement in means of transport due to railway construction, both increased the demand for wood and facilitated heavy exploita-

tion of the forests. It was thus essential for the State to take energetic action to check the constantly increasing deforestation.

The clauses of the forest law, or *forest code*, as it may well be called, provide for the maintenance of forests in the interests of public economy and take full consideration of the question of situation and soil, dealing with protection forests, forests on shifting sands and those on soils which could not be profitably used for other types of cultivation (arable or grass land, gardens or vineyards). In the forests of the first type, clearing and clear felling are prohibited : in those of the other two types only clearing. Further, removal of litter is prohibited in protection forests and forests on shifting sands ; and in these types grazing is not allowed when it might result in damage to the trees, the young growth or the soil.

The clauses relating to rational exploitation of the forests refer to forests owned by the State, by "jurisdictions" (1), by communes, by religious bodies and by the clergy ; as well as to forests under the control of special foundations and held in trust ; also to "compossessoral" (2) forests, which include those which, under the "urbarial rule" (3), have become the property of the former vassals. Lastly, these clauses are also applicable to forests belonging to limited companies founded for working mines or for other industrial undertakings. The forest law imposes the exploitation of the forests mentioned according to the plans for systematic management (Art. 17), and prohibits the employment for the purpose of persons other than forest agents who have been through a special technical training (Art. 21).

The forests of the Kingdom of Hungary occupy an area of 22 113 950 acres, which is 27 per cent. of the total area of the country. Of this area Hungary proper with Fiume possesses 18 332 010 acres (26 per cent. of its total area), while Croatia-Slavonia contains 3 781 940 acres (35 per cent of the total area). Under the forest law, the various forests are submitted to plans of management according to their nature as shown in Table I.

As the owners of communal and other forests could not themselves bear the expenses entailed by the plans of management without burdening their estates with a mortgage out of proportion to their incomes, it was necessary to make the provisions of the forest law capable of practical application. For this purpose, law XXXI of 1879 was supplemented by law XIX of 1898, by virtue of which small and large communes possessing forest property of an area of at least 5 000 arpents (7 110 acres) only have the right of maintaining forests at their own expense if they can include in their budgets the sums necessary for the management of the woods, and if the exploitation proves profitable. If this is not the case, all these forests

(1) This is the title given to bodies, counties and free or royal boroughs which formerly had the right of holding courts of justice.

(2) A "Compossesorate" is a meeting of nobility who hold in common certain land which remain in the family without division.

(3) This rule was established to allot to the peasants of every territory certain land which they received either in exchange for rights of usage or by purchase from the owne

TABLE I. — *Classification of forests for management.*

	Hungary proper with Fiume	Croatia-Slavonia (*)
	acres	acres
According to the type of land:		
Protection forest	744 370	88 820
Forests on shifting sands	274 860	709
Forests on true forest land	14 951 320	1 985 732
Forests on land not confined to forest use	2 361 459	1 706 680
According to the ownership:		
State	2 809 801	820 516
Jurisdiction, Communes	3 051 241	393 517
Religious bodies, the clergy	1 193 006	90 908
Public foundations	190 767	—
Private foundations	14 775	—
In trust	1 345 130	—
Com; ossessorates	2 754 736	1 469 853
Limited companies	311 618	47 579
Total submitted to the forest law	11 671 075	2 822 374
Private property	6 660 934	959 567

(*) The forests of Croatia-Slavonia are submitted to the system of management established by the special law of 1894 and 1895; the regulations concerning fruition and exploitation agree in essentials with those of the law XXXI of 1879.

as well as those to which art. 17 of the law of 1879 refers, shall be under the State Forestry Department.

For the administration of the forests, the owners are required to pay an annual tax. In 1912, the State administered 16 710 forest estates with an area of 5 058 432 acres. The taxes paid by the owners amounted to 792 503 crowns (£33 021), as against 2 664 142 crowns (£111 006) for the expenses of the State.

The provisions of the above-mentioned laws, as well as the data given above, show on the one hand that these laws ensure the preservation and maintenance of forests situated on land unsuitable for other cultivation, and on the other hand that they guarantee systematic exploitation controlled by the authorities to such an extent that the forests under uncontrolled exploitation represent only a very small portion of the total area of forest in Hungary. Considering the unsystematic exploitation of the preceding period, this restriction was very necessary to the forestry of Hungary; moreover, it should continue to be so, for although as regards forest area our country occupies a very good position, many of the Hungarian forests contain a relatively small bulk of standing timber, and consequently do not afford the permanent and uniform production of normal forests.

Distribution of forests and species of trees in the different parts of Hungary. — As most of the forest regions of Hungary extend along the Carpathians and their spurs, they bear the characteristics of the medium and high mountain types. In the northern forest region are found pine, silver fir, spruce and beech. The regions of the east (Eastern Hungary and

Transylvania) and the south-east, are for the most part covered with beech, silver fir and oak being of less importance. The forest region of the west is situated on the right bank of the Danube upon the slopes of the mountains of intermediate altitude; here, the principal trees are beech and oak, together with Scots pine. The region between the Danube and the Tisza, *i. e.* the Alföld, which extends to the southern frontier of the country, is the least rich in woods; here, oak and beech play only an unimportant part, and pine is almost absent; on the other hand, false acacia is found and in some places willows and poplars. In general, the forests of Hungary consist of trees belonging to the Central European flora. The respective percentages are given in Table II.

TABLE II. — *Percentage areas occupied by the different trees in Hungary.*

Beech	36.11
Oaks (*Q. Robur* [*pedunculata*] and *Q. sessiliflora*)	21.04
Turkey oak (*Q. Cerris*)	5.64
Spruce	14.34
Silver fir	4.34
Hornbeam	9.03
Birch	2.34
Poplars and willows	2.16
Ashes, elms, maples	1.42
False acacia	1.00
Scots pine	1.99
Larch	0.06
Alder	0.45
Limes	0.08

There are also found, although rarely, Austrian pine (*Pinus austriaca*) and stone pine (*P. Cembra*).

The area of 22 113 950 acres under forests in the Kingdom of Hungary is distributed as follows:

	Hungary proper with Fiume	Croatia-Slavonia
	acres	acres
Beech and other bread-leaved trees	9 084 023	2 520 175
Oaks	4 872 504	831 377
Conifers	4 375 483	430 389

Hungary possesses more beech than can be profitably used. Although beech is finding increasingly wide uses, the practice has been adopted, as a principles of forest economy for special cases, of substituting oak, pine or silver fir for it.

Forest Management. — More than 65 per cent. of the forests of Hungary are high forest; the rest are coppices, of which a very small portion are with standards. In some places, in consideration of the grazing rights, the system of grazing-forests has been maintained. The spruce and oak forests are mostly exploited by clear felling with artificial regeneration of the cleared

round, while in forests of silver fir and mixed forests the system of gradual elling obtains. In beechwoods either system is practised, according to the equirements of natural regeneration. In protection forests, and in some ther places, in order to ensure regeneration and to guarantee the productiity of the soil, selection felling obtains. Coppice growing is practised specially in the smaller forests, sometimes also for the production of tan ark; further, in the poplar and willow plantations and in *Robinia* forests hich cover the Alföld. In the high forests, the rotation varies between 0 and 120 years ; in the coppices, between 10 and 60 years.

The work of reafforestation. — In the system of the reafforestation of orests which have been cleared, artificial regeneration plays an increasngly important part. The Government shows great activity in all that concerns the replanting of the communal and other forests submitted to its management. Further, to assist regeneration, it encourages and favours the work of private individuals by means of grants, State premiums and the annual distribution of large quantities of young trees; these are supplied either gratuitously or at a low price. The forest law of 1879 havng established a National Forest Bank, maintained by fines for the infraction of regulations, its funds are destined, for the most part, to provide premiums and subsidies, and for carrying out useful forestry work. A considerable sum from the budget of the forests exploited by the State goes also to the creation of nurseries and to reafforestation. Further, a large sum is devoted from year to year to the regeneration of bare and eroded areas. Finally, the forest directions and the Treasury forest offices, as well as the foresters' schools, distribute a large number of trees for reafforestation purposes.

The following data afford an illustration of what I have just said : In 1912, the State gave 30 different premiums of the value of 15 000 crowns (£ 625) for the reafforestation of bare land effected independently of the State ; further, 1039 poor proprietors received grants of £ 6 390 for reafforesting 6 754 acres of bare land; four nurseries (116.4 acres) of the special foresters' schools furnished 6 986 000 young trees; 186 nurseries (1360 acres) administered by the forest offices provided 64 586 000 trees. Of these trees 37 265 000 were distributed free to 2101 proprietors. From nurseries with an area of 845 acres managed by the owners at their own expense, 46 million trees were used for reafforestation. Finally, 1 609 000 young trees were handed over to private individuals by the forest authorities of the Treasury. In 1912 the areas planted were :

	acres
Land to which art. 17 of the law refers	138 218
Private land	13 522
Land not prescribed for reafforestation	6 766
Total . . .	158 506

A further 74 908 acres remained unplanted on account of unfavourable climatic conditions, deficiency of seeds and want of labour.

In 1913, the National Forest Bank gave £ 2 651 8s for reafforestation. According to the budget of the communal forests, etc., a sum of £20 400

was devoted to the same object. Further, a sum of £54 000 was granted for the reafforestation of bare and eroded land.

We should also note that for a number of years the labours of the State in the domain of forestry, especially in that of afforestation, have been crowned with success : thus the replanting of the moving sands on the borders of the towns of Szabadka and Szeged amongst others, and the fixing of the moving sands of the Puszta Déliblát, constitute remarkable performances of Hungarian forestry and are also well known abroad.

Exploitation of forests and utilization of timber. — The timber felled on moderate sized forest estates is, for the most part, used by the proprietor for his domestic and agricultural requirements, so that only the larger estates are in a position to market timber ; this not only serves to satisfy the demands of the country, but also gives rise to an export trade.

The most valuable tree is oak, furnished by the forests of Eastern Hungary, Transylvania and Slavonia ; these oak woods enjoy a world-wide reputation. Then comes the fir of the Carpathians and Transylvania, which can hold its own on the European market. As for beech wood for carpentry, its exportation, especially to Italy and Spain, is progressively increasing. The chief external trade is with Austria, whence we import large quantities of deal. In 1912 the total amount imported by Hungary was 660 800 tons, worth £ 1 334 000, while 1 060 700 tons, worth £ 3 463 000, were exported.

Cattle breeding being practised on a large scale in Hungary, the question of pasturage has often caused difficulties, especially on account of the preventive measures adopted in favour of forestry. The question has been solved, thanks to the elaboration and application of the system of grazing forests, according to which the requirements of stock-breeding can be satisfied as far as the state of the forest and its soil permit. At present, most of the forests are already free from servitude and the work of dividing the properties is, to a great extent, completed.

The State forests. — In Hungary, the largest owner of forests is the Treasury. Its forest enterprise, which has long been carried out in a systematic manner, is one of the largest of the State undertakings, and is a considerable factor in its financial resources. Also from the points of view of public and economic interest, the State forests play an important part in the forestry of the country.

Table III gives the area of the State properties in the forest regions according to the branches of cultivation.

The total value of the properties amounted to £ 9 024 in 1912. The distribution of the various trees in the State forests is given for 1912 in Table IV.

With the exception of some forests of oak and of softwood broad-leaved trees in the south of the country and in Slavonia which are in the plains, the State forests clothe the mountain districts, especially in the highest zones. Above these occur alpine pastures in many districts, and the greater part of the sterile ground is also found here in the rocky regions above the limits of vegetation. The alpine pastures and the meadows are let t

TABLE III. — *Areas of the Hungarian State properties in the forest regions (acres).*

	Built-over property	Arable land	Meadows.	Pasturage	Alpine pastures	Waste land	Total of unwooded area	Forests	Total area
Hungary proper . . .	6 052	20 575	68 446	60 123	164 899	53 088	373 182	2 809 801	3 182 983
Croatia-Slavonia . .	111	3 526	2 950	34 514	1 216	18 202	60 521	820 516	881 037
Totals . . .	6 163	24 101	71 396	94 637	166 115	71 290	433 703	3 630 317	4 064 020

TABLE IV. — *Area occupied by the principal trees in the State forests of Hungary in 1912 (acres).*

	Unexploited forests	Regularly exploited forests.					
		Oak		Conifers	Beech and other hardwood broad-leaved trees	Willow, poplar and other soft-wood broad-leaved trees	Total of regularly exploited forests
		high forest	coppice				
Hungary proper. . .	306 980	265 655	4 599	912 867	1 289 657	30 042	2 502 821
Croatia-Slavonia . .	78 128	118 956	—	90 162	531 296	1 974	742 388
Totals . . .	385 108	384 611	4 599	1 003 029	1 820 953	32 016	3 245 209

the inhabitants of the respective districts. Of the alpine pastures belonging to the Treasury, about one-half are found in Maramaros county, where are established model dairies and cheese factories, which are being imitated in other districts of Hungary. In the mountainous regions, fish-breeding is also practised, trout being the most important fish. Pasturage, letting of meadows, fisheries, shooting, the temporary agricultural exploitation of clearings, brick-making and lime burning yield at present, as secondary resources of the forests, an annual revenue which may be estimated at £ 75 000, while the primary resources, which include charcoal and the production of wood for firing, carpentry and building, as well as of sawn wood (beams, props and staves) bring in an annual revenue of £ 1 000 000.

According to the budget of 1912, the expenditure on the State forests was £ 752 000 and the receipts were £ 1 033 000, which gives a balance to the good of £ 258 000, or a profit of 1s 5*d* per acre. In previous years, when circumstances were more favourable, the budget showed profits of from £ 290 000 to £ 375 000.

Before giving an opinion upon the results obtained in our time, it is necessary to take into consideration the fact, that it is not yet possible to practise in Hungary the intensive exploitation of forests which obtains in

Western countries ; on the other hand, we must not forget that wages, the great cost of transport, patronage charges and loans given free or at a low interest, are also a heavy burden upon the State enterprise.

The timber is sold by public auction, either as it stands or in depôts as sawn timber. As wood for carpentry and builder's timber is also sold retail, not only the large merchants, but also small traders, are able to purchase it. The retail sale is effected according to prices fixed in the tariff for forest products.

For transport, more than 6000 miles of large and small forest roads, 1 250 miles of waterway and 168 miles of railway are available. Much importance is now attached to the last means of transport, on account of the great distances and the large quantity of timber of enormous dimensions to be transported. The expense of the organization of means of transport, building and the purchase of real property must be estimated at £ 62 500 per annum.

The cost of the reafforestation effected in 1912 on the State properties is set forth in Table V.

TABLE V. — *Reafforestation effected in* 1912 *on the State Properties.*

	Reafforestation by means of			Total cost	Average cost per acre of reafforestation by means of			
	natural regeneration	sowing	planting		sowing		planting	
	acres	acres	acres	£	*s*	*d*	*s*	*d*
Hungary proper . .	4 352	1 337	24 489	31 517	9	1	25	8
Croatia-Slavonia . .	—	536	299	834	12	11	32	7
Total . .	4 352	1 873	24 788	32 351	—		—	

In Hungary, the Treasury nurseries (857 acres) have furnished for:

reafforestation of the State forests. . . 38 243 000 trees
private persons . . . . . 1 609 000 »
the promotion of silkworm breeding . 4 892 000 young mulberry trees.

Of the trees supplied, $^5/_6$ were pines and $^1/_6$ oaks and other broad-leaved trees.

In Croatia-Slavonia, the State nurseries (11 ½ acres) yielded 701 000 young trees for the use of the State forests.

The Staff of the State forests consists of : 501 foresters, 87 accountants, 8 clerks, 9 doctors, 22 assistant foresters, 1391 forest rangers, 266 foremen. The number of permanent woodsmen is 2300, while other workmen number about 22 000.

Organisation of the Forest Administration. — The direction of all forestry matters devolves upon the Hungarian Ministry of Agriculture, which for the accomplishment of this task has created and incorporated

two large forestry sections, of which one carries out the work relating to Hungary proper : *viz.* 1) forest inspection and administration ; 2) arrangements regarding forest exploitation ; 3) administration of the forest register ; 4) experimental service ; 5) forest statistics ; 6) control of the Staff; 7) technical instruction ; 8) the reafforestation of denuded land. The other section superintends all the economic and administrative business relating to the State forests situated in Hungary and Croatia-Slavonia, as well as all matters regarding the workmen, the proprietors and patronage.

In order to ensure the general supervision of all the forests, the country is divided into 20 districts, at the head of each of which is placed a royal forest inspector with the necessary assistants under him. In each county has been instituted a commission of forest police, to which the forest inspector is attached in the capacity of consulting member. Matters regarding infractions of forest regulations are dealt with by the administrative organs.

Compossessoral, communal and some other forests are administered by a forest direction with 43 forest offices, to which are subordinate 167 forestry agencies which extend their services to 91 counties and municipal boroughs. The forests of the city of Fiume are directly under the Ministry. In the Government administration are employed 294 superior and 100 subordinate functionaries, who supervise the reafforestation work. The proprietors are responsible for the maintenance of the foresters. The State forests in Hungary are administered by four forest directions, four chief forest offices and seven other forest offices ; in Croatia-Slavonia, they are administered by a forest direction, one chief forest office and one other forest office.

In conclusion we will give some information respecting instruction in forestry, the Service of forestry experiments and the part played by the National Forestry Society.

Forestry Instruction. — In 1770, the Empress Maria-Theresa founded at Selmeczbánya the Royal Academy of Mines, to which was annexed in 1807 a chair of forestry and from which there afterwards developed the Royal College of Mines and Forests. It trains foresters, for whom the course extends over 4 years ; only students possessing matriculation diplomas are admitted. After passing the leaving-examination, students must also pass a State examination in forestry preceded by two consecutive years of practical work.

During the scholastic year 1911-1912, the number of lecturers was 14, while the students numbered 405.

Lower grade forestry instruction is given in the four Royal Forest Rangers' Schools, founded by the State between 1883 and 1893 at Királyhalom, Vadászerdö, Liptóujvar and Görgényszentimre. The course lasts two years and the students are boarded. These schools give both theoretical and practical instruction. One of them has a normal supplementary course extending to the third year. The syllabus of the latter is so arranged as to allow of the students being employed in the administra-

tion of small private forest estates. The teaching Staff of these four schools was in 1912 : 4 directors, 4 masters, 4 assistant masters and 18 forest rangers. During the scholastic year 1911-1912, the number of students was 157. These four schools have administered : 9881 acres of forests, 116 acres of nurseries and 119 acres of botanical gardens.

Those persons who have received practical forestry instruction for three years, and have passed the examination for forest rangers may be regarded as fully competent from the technical point of view.

In Croatia-Slavonia, in 1898, a College of Forestry with a four years' course was attached to the University of Zagreb. The teaching Staff consisted of 6 special forestry lecturers, and 23 University professors and Government functionaries. The number of students in 1912 was 64. In Croatia, there is in addition a private school for forest rangers.

Service of Forestry Experiments. — In 1898, there was added to the College of Forestry a Central Station for Forestry Experiments, while four other such stations affiliated to the central one were attached to each of the Schools for Forest Rangers. These stations show great activity in all matters relating to planting, growth, conditions of cultivation, systems of management, etc. The results obtained from these experiments are published in the periodical entitled *Erdészeti Kisérletek* (Forestry Experiments) .

The *National Forestry Society*, which has its seat in Budapest, was founded in 1863. It possesses 2087 members (of whom 867 are original members and 1220 ordinary members). It has a library and has published for the last 53 years a bi-monthly periodical - *Erdészeti Lapok* (Forestry leaflets). Further, it makes a grant to the professional journal *Erdõ* (The Forest) intended for subordinate forest officials. At the end of 1913, it had a capital of £.42 072. Its aim is to increase the spread of useful information concerning forestry, and to guarantee the interests of forest agents and assist their widows and orphans.

There are in addition : three *Provincial Forestry Societies*, the *Forestry and Hunting Society*, and the *Society of Subordinate Forest Officials*.

In 1877, the *Forestry Society of Croatia-Slavonia* was founded at Zagreb ; it now has 1405 members. This society publishes the forestry journal *Sumarski List* (Journal of Forestry) and as a supplement to the latter, *Lugarski Vijestnik* (Foresters' Communications). At the end of 1913, its capital amounted to £ 7856.

Report on the Poultry Industry in South Australia

by

D. F. LAURIE,

Poultry Expert & Lecturer.

From the earliest days of the founding of this State, poultry keeping has formed a by no means inconsiderable branch of rural industries. It was soon found that the equable climate and general conditions were most

favourable to all breeds and varieties of domestic poultry. Various importations of different breeds were made from time to time until in due course the newest breeds and varieties evolved in other countries were soon represented here. The fancier was primarily responsible for the introduction of the various breeds, and very soon poultry societies and shows were organised. At the present time there is one Metropolitan Society, in addition to which the Royal Agricultural and Horticultural Society does much to encourage the poultry fanciers, and provides numerous classes at its Shows. In the country districts are numerous poultry societies, and also Agricultural Societies which provide classes for poultry at their annual shows. Specialist clubs attend more particularly to the welfare of several of the prominent breeds.

The poultry fanciers as a rule are not large breeders, and few breed more than two hundred chickens in a year. Farmers thoughout the State keep flocks varying in numbers from one to five hundred. The utility breeders, collectively, are becoming an important factor in this State, and many of them breed from one to five thousand or more chickens in a season. At the present time there is a general move in the direction of larger plants, and several are in operation which will shortly provide for several thousand layers and the production annually of many thousands of chickens. Egg production is receiving more attention than flesh production, as the general opinion is that the former is the more certain, and also the more profitable branch.

Among the utility breeders for egg production the White Leghorn (Australian type) is the most popular. There are a few who breed Minorcas, Brown Leghorns, and laying strains of Orpingtons, Langshans and Wyandottes. The all round breeds such as Orpingtons and Wyandottes, Langshans, and Plymouth Rocks are bred in fair numbers and there is every evidence that there will shortly be a great revival in these, or at amy rate some of them.

Imports. — No poultry or eggs for human consumption are imported into this State. Poultry breeders import on the average about a thousand head of various breeds from the other States, and oversea, for breeding purposes. They also obtain from the other States annually a few hundred dozens of eggs for hatching.

Exports. — Shipments of eggs in cold storage have been successfully sent to England. Each year some thousands of chickens and ducklings have also been shipped to England where they realised excellent prices. At the present time the great prosperity and rapidly increasing population of the Australian States result in excellent markets for all our available surplus. Increased prosperity and large demand have resulted in very materially improved prices, so that the prospects of the oversea trade, as at present, are not so enticing as they were. The annual value of eggs and poultry sent to the other Australian States is over £ 150,000, and the annual value of the poultry products of this State is £ 750 000. While the growth of the industry has been satisfactory as regards quantity, the increased value is largely due to the higher prices obtained for the products.

TABLE I. — *R*

		No. of Hens.	Eggs Laid.	Average per Hen
1st Test, held at Magill	1903-04	156	20 630	132
2nd » » Roseworthy	1904-05	186	21 701	117
3rd » » »	1905-06	186	31 962	171
4th » » »	1907-08	450	80 959	179.9
5th » » »	1908-09	336	63 818	190
6th » »	1909-10	678	126 133	186
7th » »	1910-11	534	102 723	192.3
8th » » »	1911-12	756	133 093	176.0
9th » » »	1912-13	804	146 329	182

Large numbers of high class stock are sent to the adjoining States, New Zealand, South Africa, America, India, and other parts.

Prospects of the industry. — There is no branch of rural activity which can offer to the producers of this State a more satisfactory prospect, as regards markets. Not only are the interstate markets satisfactory and likely to continue, but in addition the general shortage in the World's supplies of eggs and table poultry affords markets in England and on the Continent, which will be available for profitable exploitation in the near future.

Government Assistance. — Seventeen years ago the Government of the day was struck by the possibilities of the industry. An experienced breeder and expert was appointed to lecture in the country districts and to write pamphlets and articles and to take steps to promote the breeding of poultry on commercial lines. Grants of money were made to various poultry and agricultural societies to provide prizes to encourage the breeding of certain specified breeds of poultry.

Exhibits of an instructive nature were organised, and staged at the metropolitan and the chief country agricultural shows. These exhibits demonstrated the best methods of packing eggs and poultry for market. Principal foods, with their uses and feeding values, were shown, together with a mass of valuable information in statistical form easily understood. In connection with the export trade to England the State made cash advances on both eggs and poultry shipped, in addition to undertaking the grading, packing and shipping of eggs, and the killing, preparation, grading and packing of table poultry, also the sale in England.

The Poultry Section of the Department of Agriculture is organised as follows:

The Poultry Expert & Lecturer is officer-in-charge, assisted by two Inspectors. Correspondence, which includes a large amount of instruction, the designing of poultry plants for breeders, investigation of

e series of Tests.

Eggs Laid by Winning Pen.	Market Value	Cost of Food per Hen.	Return per Hen.	Profit per Hen.	Average Price of Eggs per Doz.
	£ s. d.	s. d.	s. d.	s. d.	d.
1 032	77 7 8	7 9	9 11	2 2	10.8
1 251	58 7 4	3 1	6 3¼	3 2	7.74
1 343	98 10 11	4 11	10 7	5 8	8.8
1 531	273 0 0	5 4½	11 10	6 5½	9.8
1 447	232 19 10	5 9¾	13 10	8 0¼	11.09
1 531	470 12 5	5 6½	13 10	8 3½	11.54
1 513	358 17 8.9	5 10½	13 5	7 6½	11.2
1 589	545 6 2.7	4 11½	14 4¾	9 5¼	11.8
1 413	663 11 2	5 7.8	16 6	10 10.2	13.06

diseases, the inspection of poultry yards under the Stock Diseases Act, are carried out from the Adelaide Office.

The Expert lectures at various country centres in connection with local Agricultural Bureaux and Agricultural and other societies. He also lectures at the Agricultural College, Roseworthy, and gives annual courses at the School of Mines & Industries. Personal visits of inspection and to impart advice on the spot are paid by the Expert and Inspectors. Beginners are supplied with plans of buildings, the erection of which is supervised; and, if required, all operations are overloooked.

Publications. — Through the Departmental Journal of Agriculture breeders are supplied each month with information contained in seasonable notes, general and special articles. Much time is given to original research on diseases and parasites and the results are published in the Journal and in Bulletin form. A "Poultry Manual" (now in the third edition) is on sale at a nominal price. All other publications, including an extensive Annual Report and Bulletin on the Egg Laying Competitions, are distributed gratis.

Poultry Experiment Station. — Until recently there were three Poultry Stations, one at Roseworthy, on the Agricultural College grounds, one at Murray Bridge, and one at Kybybolite, in the south east part of the State.

It was deemed desirable, for many reasons, to concentrate all work at one centre and a new site was chosen at Parafield, near Salisbury. Parafield was formerly a wheat-breeding station and consists of 100 acres of first-class wheat land, but rather heavy for poultry. The distance from Adelaide is only 11 miles by rail and about 10 miles by road. Here will be assembled, with many additions, the dismantled poultry stations removed from the old sites. The accommodation now in course of provision will include a block of 160 pens for the Laying Competition, yards and

houses to accommodate 5000 laying hens, and 150 pens of breeding stock with chicken-rearing yards to accommodate 10 000 to 12 000 chickens. There are two incubator rooms fitted with Cypher's hot-air machines of 400 egg capacity. Two brooder houses each 100 ft. long are provided, and the brooders and incubators are heated by an air gas (gasoline) plant, which will save labour and obviate many disabilities. Food stores, and distributing houses, workshops, stables, etc., are also in course of erection. Water is laid on to all buildings and pens. The whole of the land will be under cultivation, and considerable areas of lucerne and other fodder crops will be grown under irrigation.

In addition to the Laying Competition it is intended to organise Single Testing Competitions. Each competitor will enter 6 pullets, each of which will be confined in a small house and run : this is a more accurate and scientific method than trap nesting. Food tests will be carried out, and many problems connected with incubation, breeding, etc. will be dealt with. It is intended to accommodate sufficient laying hens to provide sufficient revenue to make the Station self supporting.

The education value of this easily accessible Poultry Station will be very great.

Later on provision will be made for students and also for the delivery of short lectures to the public on visiting days. The present staff consists of seven assistants, Assistant Superintendent, Superintendent and two farm hands. In addition to the 930 competition birds there are 50 pens of breeding stock and about 2000 layers. The breeds are White Leghorns and American Barred Plymouth Rocks. Later on some other breeds will be stocked.

The Laying Competition. — The results of the South Australian State controlled Laying Competitions have attracted attention throughout the world. The object of these tests is to demonstrate that it pays to breed good strains of layers and also to house and feed them properly. These three important considerations are not always understood, nor is their true value recognised.

Table I (pp. 1402-1403) shows the results of the Competitions hitherto held.

The current test 1913-14 consists of 154 pens, the largest number ever gathered in one test.

There are three sections: Sec. 1. Light Breeds; Sec. 2. Heavy Breeds; Sec. 3. Pens entered by Farmers, Pastoralists, Fruit and Vegetable growers.

The egg production in the first three months is satisfactory and there is every prospect that the final result will uphold the great reputation of the fowls of this State.

Experimental and Research Work.

Feeding poultry for egg production. — During recent years continuous feeding tests have been carried out at the Poultry Stations in connection with the Egg Laying Competitions, which are organised by the Department of Agriculture.

TABLE II. — *Feeding Test from June 1st, 1910, to May 31st, 1911 (12 Months).*
10 *White Leghorn Pullets in each Test.*

Pen.	How Fed.	June.	July.	August.	September.	October.	November.	December.	January.	February.	March.	April.	May.	Total.
1	*Morning.* — Mash, ground rye, wheat, bran, meat meal *Midday.* — Green feed. *Evening.* — Rye, grain in litter	89	63	94	82	187	151	105	129	50	152	66	16	1 184
2	*Morning.* — Mash, oat flour, wheat, bran, meat meal *Midday.* — Green feed *Evening.* — Oats in litter	101	116	104	107	133	153	107	178	71	172	70	5	1 317
3	*Night & Morning.* — Mixed grain *Midday.* — Green feed	82	104	147	130	169	123	93	128	63	101	10	4	1 154
4	*Morning.* — Grain. *Midday.* — Green feed *Night.* — Competition mash	93	108	128	99	161	122	112	163	102	108	25	4	1 225
5	*Morning.* — Half competition mash, half grain *Midday.* — Green feed *Evening.* — Same as morning	62	83	139	91	160	112	93	150	44	108	55	11	1 108
6	Dry competition mash continuously in hopper *Midday.* — Green feed *Evening.* — Grain in litter.	45	62	69	53	125	77	90	98	61	71	78	24	853
7	*Morning.* — Competition mash *Midday.* — Green feed *Evening.* — Grain in litter	44	32	74	67	158	180	133	125	70	122	67	19	1 091
8	*Morning.* — Competition mash with double meat *Midday.* — Green feed *Evening.* — Grain in litter	60	43	94	97	145	187	157	144	76	124	58	11	1 196
	Total	576	611	849	726	1 238	1 105	890	1 115	537	958	429	94	9 128

TABLE III.

Breed	Total Number Eggs Laid for March.	Total Number Eggs Laid for Year.	Average per Pen.	Average per Hen.	Number of Deaths.
Black Orpington	140	3 495	699	116.5	7
Silver Wyandotte	392	4 930	986	164.3	3
White Leghorn	273	5 515	1 103	183.8	2

TABLE IV. — *Egg production of various breeds.*

Number of Pens	Number of Birds	Breeds.	Total	Average per Pen	Average per Hen
65	390	White Leghorn	77 523	1 192.67	198.7
19	114	Black Orpington.	20 045	1 055.2	175.8
4	24	Buff Orpington	3 940	985.2	164.2
2	12	White Orpington	1 582	791	131.8
5	30	Silver Wyandotte	5 500	1 100	183.2
4	24	White Wyandotte	3 777	944.25	157.3
3	18	S. C. Brown Leghorn	3 012	1 004	167.3
2	12	R. C. Brown Leghorn	1 987	993.5	165.5
2	12	Minorca	1 915	957.5	159.5
2	12	Langshan	2 106	1 053	175.5
1	6	Black Leghorn	964	964	160.6
1	6	Buff Leghorn	738	738	123
1	6	Ancona	1 000	1 000	166.6
1	6	Andalusian	961	961	160.1
1	6	Plymouth Rock	1 069	1 069	178.1

Throughout the series the feeding has been only slightly varied and is as follows:

7 a. m. — Mash, a mixture made as follows: bran 1 part by weight is scalded over night generally with soup made from meat meal; this i mixed with pollard two parts, and worked to a crumbly mass. Sometime lucerne hay chaff, in the proportion of about one third of the bulk, is used At noon a supply of cut green food is fed, and in the evening a meal o grain, which is generally wheat. In cold weather maize, oats, and pea are fed occasionally.

It may be added that the birds are confined in yards 10 feet wide, b

TABLE V. — *Fertility Test* (Male bird removed Dec. 12).

Date Eggs Laid	Eggs set.	Fertile	Infertile.	Per Cent.
1911				
December 12th	10	10	—	100
» 13th	10	10	—	100
14th	10	10	—	100
15th	10	9	1	90
16th	10	10	—	100
17th	9	7	2	77
» 18th	10	9	1	90
» 19th	10	9	1	90
» 20th	10	8	2	80
» 21st	10	7	3	70
» 22nd	6	3	3	50
23rd	7	3	4	42
» 24th	6	3	3	50
» 25th	10	2	8	20
» 26th	7	—	7	—
» 27th	10	2	8	20
» 28th	10	1	9	10
» 29th	10	—	10	—
» 30th	10	—	10	—
31st	9	—	9	—
1912				
January 1st	10	—	10	—
» 2nd	10	—	10	—
» 3rd.	10	—	10	—
» 4th.	10	—	10	—

40 feet long, with a house at one end. The yard is floored with scratching litter.

Testing various foods. — To test various foods and methods of feeding, 80 carefully selected White Leghorn pullets were divided into flocks of 10 each, housed and yarded under similar conditions.

Table II (p. 1405) shows the results.

Breed tests. — A further test extending over 12 months was made. In this test 30 carefully selected pullets of each of three breeds were taken. The results are shown in Table III.

In the various detailed reports of the Egg Laying Competitions the results of the egg production of each breed represented have been tabulated.

TABLE VI. — *Weights and Measurements of Eggs and Shells.*

No	Breed	Weight	Length, Long Diameter	Breadth, Short Diameter	Thickness of Shell					Weight of Shell	Weight of Shell as percentage of egg	Color and Appearance of Shell
					Large End	Small End.	Middle	Average	Breed Average			
		gms.	cm.	cm.	mm.	mm.	mm.	mm.	mm.	gms.		
1	Black Orpington	66.95	6.16	4.43	0.371	0.423	0.413	0.402	0.423	8.53	12.47	Brown, good, large
2	Black Orpington	52.15	5.41	4.13	0.512	0.431	0.394	0.445		6.21	11.90	Tinted, good, medium
3	Buff Orpington.	62.75	5.91	4.26	0.561	0.441	0.501	0.501	0.464	7.38	11.60	Brown, good, large
4	Buff Orpington.	51.65	5.63	4.11	0.392	0.472	0.421	0.428		6.39	12.37	Brown, good, medium
5	White Orpington	60.87	5.89	4.21	0.399	0.423	0.422	0.414	0.414	7.18	11.79	Brown, good, medium
6	Plymouth Rock	71.85	6.09	4.59	0.451	0.432	0.549	0.477	0.465	8.08	11.24	Brown, good, large
7	Plymouth Rock.	58.25	5.52	5.29	0.442	0.473	0.448	0.454		7.68	13.18	Brown (dark), large
8	Silver Wyandotte.	62.86	5.78	4.37	0.439	0.489	0.458	0.462	0.455	7.15	11.37	Tinted brown, large
9	Silver Wyandotte.	47.15	5.21	3.98	0.472	0.451	0.423	0.448		6.18	13.10	Tinted brown, small
10	Langshan	61.55	5.77	4.32	0.423	0.381	0.458	0.420	0.428	6.54	10.62	Brown, large
11	Langshan	58.41	5.62	4.29	0.451	0.481	0.379	0.437		6.93	11.86	Brown, medium
12	White Leghorn	75.65	6.18	4.71	0.466	0.451	0.442	0.453	0.423	8.63	11.40	White, large
13	White Leghorn	57.37	6.11	4.18	0.399	0.393	0.392	0.394		6.29	10.96	White, medium
14	Black Minorca	73.16	6.05	4.67	0.445	0.448	0.549	0.480	0.492	8.92	12.19	White, large
15	Black Minorca	68.75	6.02	4.45	0.431	0.573	0.511	0.505		8.14	11.84	White, large
	Average	61.95	5.82	4.39	0.443	0.450	0.450	0.448	—	7.34	11.87	

Table IV (p. 1406) is representative of this and concerns a number of different breeds and varieties.

Fertity test. — At the close of the breeding season a test was carried out to ascertain how long after the removal of the male bird from the breeding pens the eggs laid would be fertile. The result is shown in Table V (p. 1407).

These Tests were confirmed on other occasions.

Weights and measurements of eggs of various Breeds of Fowls. — A dozen average eggs of fifteen different breeds and varieties of fowls were selected and carefully measured and weighed. Table VI shows the results.

Loss of weight in eggs during incubation. — Numerous experiments have been made. Careful records have been tabulated of the temperatures and moisture content of the air of the incubator rooms and of the incubators. Hot-water heated and hot-air heated machines were used. The average loss of weight per egg was found to be: hot-air machines, 16.24 per cent; hot-water machines, 15.78 per cent.

Flesh production. — Among other tests certain pure breeds and crosses were selected and fed with a cramming machine. The results are as follows:

Breed	Average increase per bird.
Indian Game crossed S. Wyandotte	2 lbs. 1 oz.
Buff Orpington	1 » 5 ½ »
White Wyandotte crossed O. E. Game	1 » 5 »
Indian Game crossed Dorking	1 » 2 »
Black Orpington	1 » 2 »
White Leghorn	14 ½ »
Faverolles	15 ½ »

Investigating diseases of poultry. — Most diseases of poultry are due to the presence of ecto and endo parasites. The following are met with and have at various times been the subject of investigation.

Parasite.	Disease caused
Argas persicus	Spirochaetosis
Goniodes sp.	Phthiriasis.
Goniocotes	Are probably carriers of spirochaete and other endo-parasites.
Menopon	
Lipeurus.	
Dermanissus gallinae	Coccidiosis in fowls and turkeys. Little Chick Cholera.
Coccidium avium (gallinae)	
Nematoda (Heterakis sp.)	Malnutrition, arrested metabolism and septicaemia.
Taeniae	Taeniasis.
Demodex	Itch, etc.
Sarcoptes	Scaly leg.
Lophophyton	Lophophytosis (Favus).

Various diseases, such as roup (generally due to invasions of *Bacillus diphtheriae gallinae*) and chicken pox (due to a fungoid parasite), are commonly met with and have been carefully studied. Preventive measures in all cases are advised as the only scientific method as regards successful poultry culture. Bulletins on some of the above parasites have been published and others will appear in due course.

Work of the Entomological Section of the Swedish Central Agricultural Experiment Station, during the Years 1907-14.

by

Prof. ALBERT TULLGREN,

Director of the Section.

The Entomological Section has had from the beginning a twofold aim. On the one hand it gives the public advice and information on all questions connected with agriculture and kindred industries, and on the other hand it works at the theoretical and practical solution of certain problems of economic importance, such as the life history of animal pests and the means of controlling them.

This latter field of activity should naturally be the most important for the Section, as the scientific and practical solution of the problem connected with animal pests forms the necessary basis for really useful advisory work; nevertheless the actual state of things is quite different, owing to several obstacles which have hitherto been unsurmountable. During the period 1907-14 the Section has, in the first place, accomplished a vast amount of informatory work. The public has availed itself of this privilege in a large measure; the Section endeavours at the same time to keep in close touch with farmers by means of correspondence and the diffusion of articles drawn up in a popular form. There is no doubt that these efforts have been attended by much success, as is proved by the fact, among others, that the control of the commonest animal pests — at least in the domain of horticulture — has become, of late years, more general and more intense.

One of the factors of the informatory work of the Section — a factor which also favours to a great extent practical and scientific research, — is the service started in 1911 which has taken the name of Intelligence Service. Its chief object is to supply a certain, and if possible, complete knowledge of the distribution, frequency and life-history of injurious animals in Sweden, as well as the value of the means of control, etc.

There are in different parts of the country about 500 persons ready, according to their culture and available time, to transmit at certain periods reports on the animal pests of their districts. These reports include not

only the animals which injure field crops, but also those which cause damage to gardens, orchards, and forests. All these reporters have the advantage of being entitled to send their correspondence and samples post free.

The Intelligence Service has, as has been said above, two advantages. On the one hand it facilitates the relations between the Section and the public, and on the other it supplies the Section with considerable material for study. By means of the correspondence and research work on the samples sent in, the Section endeavours to determine, as far as possible, the exactness of the communications received. The reporter who has taken part in this work for some years and has become interested in it acquires a relatively good knowledge concerning the commonest animal pests and may in his turn supply information. The Section has already learned a good deal from the reports that it has received. Thus, for instance, the knowledge on the distribution and life-history of *Argyresthia conjugella* Zell. and of *Aphis padi* L. has been enriched by precious contributions.

As regards the scientific activity of the Section, it may be stated that it has illustrated, in its principal publications, the life-history of many injurious animals of importance to Sweden. One of the insects most injurious to fruit trees in the country, the above-mentioned *A. conjugella*, has especially been the object of diligent study. The results of these investigations have been published in the " Communications " of the Central Institute. For several years past the aphides of Sweden have been studied with the greatest care. The first part of a monograph on them was published in 1909. Of late years the life-history of several Tenthredinids has been likewise studied. To these works must be added researches on Acari, wood-boring Lepidoptera, and Coleoptera (such as the larvae of Elateridae and of Halticinae) of importance from an economic point of view. Some of the results obtained have also been published in our " Communications ".

As for the practical and experimental work, the following deserves special mention. A vast series of investigations has been carried out in the matter of the utility of carbolineum in horticulture. The result of these investigations has been that spring spraying with 8 to 10 per cent emulsions has been proved to be extraordinarily efficient against several animal pests, such as apple sucker (*Psylla mali* L.), pear-leaf blister mite (*Eriophyes piri* Pagst.) and numerous scale-insects. On the other hand it has been ascertained that against fungi the utility of carbolineum is very limited, and that in certain cases it may prove fatal to plants.

Numerous experiments have also been made with lime-sulphur washes, partly to check results obtained abroad and partly to increase our knowledge regarding this important means of control.

Among arsenical compounds used in sprays, only Paris green and arsenate of lead were experimented on a large scale. Good results against the animal pests of Cruciferae have been obtained by adding to the wash substances capable of increasing its adhesiveness, such as gelatine.

Besides the above-mentioned sprays, the Section submitted to critical examination a great number of other products, including two English preparations for the disinfection of the soil : " Vaporite " and " Apterite ". But all these investigations yielded almost exclusively negative results.

Among the injurious animals — which of late years have attracted special attention — the following deserve to be mentioned : winter moth (*Cheimatobia brumata* L.), codling moth (*Carpocapsa pomonella* L.), *Argyresthia conjugella* Zell., apple sucker (*Psylla mali* L.), pear-leaf blister mite (*Eriophyes piri* Pagst.), *Agriotes* sp., *Phyllotreta* sp., *Haltica* sp., *Phaedon cochleariae* Fabr., *Hyponomeuta* sp., *Coleophora laricella* Hbn., *Tetranychus* sp., *Bryobia praetiosa* C. L. Koch.

The efforts of the Section to improve its material position also form a part of its work. Its desires have been to a great extent realized of late years. In 1913 a new building for the Institute was erected ; it is spacious and arranged in the most modern manner to meet the requirements of practical and scientific experiments. A remarkable collection of preparations illustrating the cycle of development and the habits of our animal enemies, an important collection of photographs, and a rich library may also be considered as, to a great extent, the result of our activity during recent years.

SECOND PART.

ABSTRACTS

AGRICULTURAL INTELLIGENCE

GENERAL INFORMATION.

LEGISLATIVE AND ADMINISTRATIVE MEASURES

5 – **Encouragement of Olive Growing and Fruit Growing in Tripolitania.** — *Decreto del Governatore.* Tripoli, Augnst 6, 1914.

On the suggestion of the Director of the " Ufficio Agrario " of Tripoli, l growers shall be entitled to a grant of 4 *d* for each properly grown young ive plant obtained from seed or from cuttings and 2 ½ *d* for every almond other fruit tree grafted. The " Ufficio Agrario " is authorised to distri- ute a suitable number of olive plants (" ovoli " or cuttings) and grafted uit trees to growers who apply for them and give the assurance that ey will undertake to cultivate them according to the recognized agri- ltural practice.

DEVELOPMENT OF AGRICULTURE IN DIFFERENT COUNTRIES

6 – **Agriculture in Réunion.** — *Ministère des Colonies Bulletin de l'Office colonial,* Year 7, No. 78, pp. 300-309. Melun, June 1914.

The island of Réunion has an area of 970 sq. miles. It is essentially olcanic and is divided into two groups of mountains joined on the south- est by the Plaine des Cafres and on the north-east by the Plaine des almistes.

Réunion is an essentially agricultural country ; plants from all parts the tropics flourish in the littoral zone and those from temperate regions the mountainous interior. All the land is available to cultivation cept the forest reserves established in 1874, which comprise nearly o sq. miles. The remaining portion is distributed as follows :

	sq. miles
Coast zone suitable for cultivation	390
Cultivable area in the cirques and islets	75
Area unsuitable for cultivation	115

Soils. — The soils consist of volcanic matter in different degrees disintegration, the process being most advanced in those of the north-w mountain group, where also the deepest sediments occur. They are ch racterised by a low percentage of lime and potash, probably due leaching.

Climate. — Two types of climate prevail : one in the east, exten ing from St. Joseph to St. André with a rainfall of 2300 mm. (90 inche and the other with a rainfall of scarcely 900 mm. (36 inches). There a two distinct seasons : the cool season from May to October with a mi imum mean monthly temperature of 21.15° C. (July) ; the warm seas from October to April with a maximum mean monthly temperature 27.5° C. (February). The only danger to crops is from cyclones whi often lower the yield by 20 to 40 per cent.

Agricultural Position in 1892 *and* 1912.

Area cultivated		In 1892	In 1912
		acres	acres
Sugarcane		72 000	47 000
Vanilla		1 680	1 380
Coffee		3 830	2 970
Cacao		62	86
Cloves (isolated trees)		area undetermined	
Tobacco		865	1 240
Manioc		3 880	8 650
Aromatic plants		740	4 000
Maize		37 000	50 000
Fallow, bare or cropped		50 000	37 000
Various crops, potatoes, orchards, vegetables, gardens		15 000	12 500
Exports.			
Sugar	tons	37 800	37 960
Vanilla	lbs.	212 235	148 051
Coffee	»	426 191	30 515
Cacao	»	1 883	1 378
Cloves	»	2 930	309
Tobacco	»	83 319	247 846
Essential oils	»	23 732	103 593
Rum	gallons	370 026	774 772
Tapioca and starch	tons	654	2 037
Dried manioc	»	—	242
Choco (*Sechium edule*)	lbs.	—	108 097
Spirits from sugar cane	gallons	—	51 328
Fourcroya gigantea fibre	tons	—	202
Preserved fruits	lbs.	—	21 475

The total value of the exports of the chief agricultural products ma be estimated at £578 000 in 1892 and £645 000 in 1912 ; it should b noted that in the latter year the price of sugar was very low : 9*s* 8*d* t 10*s* 6*d* per cwt.

Price of land. — The average value per acre varies from £16 to £64 cording to the locality, and it has not appreciably varied during the st 20 years.

Sugarcane. — This crop covers about a quarter of the cultivated ea. From 1870 to 1912 the annual production varied between 20 000 d 38 000 tons, reaching a maximum of 46 000 tons in 1895. Some richer rieties have recently been introduced and propagated, *viz.*: Bigtanna, , Boabilla, Cristalline, No. 100, etc. Under good cultivation they yield to 19 per cent. of sugar. Chemical manures are in common use, sulting in bigger yields being obtained. The factories provided with cylinder mills and defibrators obtain from 1500 to 1550 lbs. of juice per n of cane.

Vanilla. — The average yield from 1892 to 1912 was about 70 tons, aching a maximum of 200 tons in 1898. The crop gives excellent re-lts in the island, but has suffered considerably from recent cyclones.

Coffee. — The yield of coffee has fluctuated considerably between 892 and 1912. The exports have fallen from 426 190 lbs. in 1892 to 3 755 lbs. in 1900 and 30 515 lbs. in 1912. This is coincident with a fresh utbreak of *Hemileia* in 1900, which was successfully treated with copper prays, but in 1902 occurred an outbreak of *Lecanium viride*, introduced om Mauritius and Ceylon. New species have been introduced, but the lanters prefer the old types, *arabica* or round coffee and *roy* or pointed offee.

Aromatic plants. — The cultivation of these plants has increased nsiderably during the last 20 years. In 1892, 23 732 lbs. of essence of eranium and ylang-ylang, valued at £20 000, were exported. The xports in 1912 were as follows:

	lbs.
Essence of geranium	95 105
» » vetiver.	3 132
» » ylang-ylang	4 718
» » patchouli	110
» » citronella	489
» » longose	40

epresenting a total value of £90 730. Geranium is extensively cultivated. lang-ylang has taken a more important place with the rise in price of is essence, which reached nearly £10 per lb.; important plantations ere established in the littoral zone and continue to exist to-day in spite f the fall in price. Other plant essences, such as patchouli, citronella, emon-grass, gardenia and "longose", are distilled with success.

Manioc. — This crop has increased greatly since 1892, when there ere only three mills dealing with about 12 million lbs. of manioc. At ne present time there are seven mills producing about 4 ½ million lbs.of our and tapioca from about 40 million lbs. of tubers. During recent years ried manioc has been exported in small cakes containing 85 to 90 per ent. of flour. This product is used in France in the preparation of alcohol r liqueurs.

Textile plants. — The crop from these is not very profitable. *Fo croya gigantea*, or Mauritius hemp, yields only 35 to 40 per cent. of fib Sisal hemp (*Agave Sisalana*) yields a greater percentage of fibre fetchi a higher price. An experiment in jute cultivation at the Botanic Gard was successful and the cultivation of this crop should be very importa in the island, since more than half a million sacks are used annually in t sugar and manioc industries.

New crops. — Several new crops have been introduced during the pa 20 years, the most important being the following : varieties of manioc ri in starch ; sugarcane from Mauritius, Hawaii, Barbados, Australi disease-resistant coffees, including *C. robusta*, *C. stenophylla*, *C. congens C. canephora*, and the varieties Maragogipe and Golden Drop, as well some Javanese hybrids ; new varieties of exotic tobacco, of which Mar land, White Burley, Connecticut and Szamoshati have given excelle results as cigar leaf ; new selected varieties of aromatic plants, andr pogon, citronella, lemon-grass, patchouli, longose, gardenia, ylang-ylan peppermint. New varieties of sisal hemp have been planted on a lar scale. Since 1911 *Canna edulis* has been cultivated on the high plateau it yields a flour highly prized by biscuit makers. Of new forest plan the following have been introduced : the carob, Java kapok, various ta nin-yielding acacias, *Styrax benzoin*, etc.

New industries. — Preparation of perfumes by volatile solvent new factories for the distillation of flowers with modern fractional distill tion apparatus ; a ground-nut-oil factory. The apparatus in the sug factories has been greatly improved. A hydro-electric motor has be installed for supplying electric power to the port from the Galets strea

The *Agricultural Service* was founded in 1854 with the institution a Botanic Garden for the multiplication and preservation of useful plan in the colony. In 1907 a School of Agriculture was founded at Providen and in 1911 an experiment station followed. A scheme of reform for th experiment station and reorganization of the Agricultural Service h been presented to the General Assembly.

AGRICULTURAL INSTITUTIONS

977 – **The Royal Colonial Garden at Palermo.** — *Communication from the Directo Professor* A. Borzi.

The Colonial Section of the Botanic Garden of Palermo, which h existed since 1907, has now acquired autonomous administration with th functions of State Colonial Garden. In its new form, this institute w study and experiment with exotic plants useful in industry and commerc with a view to the agricultural and economic development of the colonie and to the increase of agricultural production at home by means of ne crops.

CROPS AND CULTIVATION.

978 – **The Effect of Climatic Conditions on the Rate of Growth of Date Palms.** – VINSON, A. E., in *The Botanical Gazette*, Vol. LVII, No. 4, pp. 324-327 + 2 diagr. Chicago, April 1914. AGRICULTURAL METEOROLOGY

The observations on which this study of the effect of climate on the rate of growth of date palms is based were made at the Cooperative Date Orchard, Tempe, Arizona. The length of every leaf on four palms — two Deglet Noors and two Rhars — was carefully measured every week during 1906 and 1907. By the system adopted the maximum error did not exceed one-quarter inch. Daily records were also kept of maximum and minimum atmospheric temperatures, and of soil temperatures at 1, 3 and 5 ft. below the surface. It was observed that after a new leaf has emerged well from the central bud, it makes the greater part of its growth in five or six weeks. In order to obtain a series of comparable figures representing weekly growth it was found that the sum of the elongation of the inner five leaves gave the most satisfactory series.

Both years the rate of growth was maintained late into the autumn, considerably in excess of the amount of heat available.

The rate of growth is most active not at the period of highest maximum, but rather at that of the highest minimum temperatures, which means warm nights. This period coincides with the summer period of highest relative humidity, that is, in Arizona, in July, August and sometimes September, and it is at this time that weakly palms recover their vitality. By far the greater part of the total yearly growth falls in the second half of the year. The rate of growth throughout the entire year is, in most cases, in proportion to the heat-time units over 50° F. (10° C.). Humidity is undoubtedly an important factor, but probably less so to date palms than to other plants.

The rate of maturation of the fruit is probably influenced by the same factors as the rate of growth of the foliage. The effect of high minimum temperature in promoting the ripening of the Deglet Noor date has recently been observed at Gafsa, in Southern Tunis.

979 – **The Influence of Sulphur on Soil Acidity.** — LINT, H. CLAY (New Jersey Agricultural Experiment Station, New Brunswick) in *The Journal of Industrial and Engineering Chemistry*, Vol. 6, No. 9, pp. 747-748. Easton, Pa., September 1914. SOIL PHYSICS, CHEMISTRY AND MICROBIOLOGY

Considering the favourable results obtained by the application of flowers of sulphur to the soil for the control of some parasitic fungi which are capable of persisting in the soil (for instance *Oospora scabies*, which causes potato scab), the question of its effect on the acidity of the soil acquires a certain importance.

The researches of DEMOLON (1), BRIOUX and GUERBET have not only proved that the sulphur in the soil is converted into sulphates by bac-

(1) See No. 478, *B.* May 1913. (*Ed.*).

terial action, but they have furnishd data on the influence of various substances such as calcium carbonate, saccharose, peptone, etc., when added to the soil in which the sulphur was introduced.

In the writer's recent work under field conditions, as much as 600 lbs. of sulphur was applied per acre; it was noticed that a large amount of the sulphur was still present at digging time apparently in an unchanged condition. In order to ascertain facts on the rate of oxidation of the sulphur in the soil a series of tumblers containing 100-gram portions of soil were arranged, one-half containing sulphur, the other half without it; 33 mgms. of sulphur, equivalent to 1000 lbs. per acre-foot (3 000 000 lbs.) were added. The soils were made up to 20 per cent. moisture content and covered with Petri dishes. The moisture content was kept practically constant throughout the experiment, which lasted 11 weeks. One tumbler containing soil mixed with sulphur and one without were removed each week and tested for acidity.

It appeared that the sulphur had almost all been oxidized within the first eight or nine weeks. There is very little change in the acidity after the seventh week.

The fact that sulphur causes this increase in acidity under field conditions is shown by the following table, in which are the analyses of soils from four old potato rows to which sulphur had been applied the preceding year; the fifth row had not received any sulphur.

In valuing the results it must be borne in mind that rows 1 and 2 had received ammonium sulphate, while rows 3 and 4 had had sodium nitrate.

Row	Rate of sulphur application, lbs. per acre	Lime requirement, in lbs. CaO per acre
1	600	3 187
2	300	2 590
3	600	3 025
4	300	2 247
5	none (check)	883

Laboratory experiments show that sulphur oxidizes more rapidly in sandy than in clay loams, and in those kept constantly at 20 per cent. of moisture than in those allowed to dry from time to time.

980 – **Acid Mineral Soils.** — DAIKUHARA, S., in *The Bulletin of the Imperial Central Agricultural Experiment Station, Japan* (article in German), Vol. II, No. 1, pp. 1-40 + 1 table. Nishigara, Tokio, March 1914 (1).

The acid reaction of certain soils is generally due to the presence of humic acids: other causes are the oxidation of pyrites particles, repeated application of certain fertilisers, such as sulphates of ammonia and potash on soils poor in lime, volcanic emanations or the initial fermentation of organic manures, such as green crops, cakes, straw, fresh dung. There is another instance of acidity in purely mineral soils which has not yet been

(1) See also preliminary note, abstract No. 600, *B.* July 1914. (*Ed.*).

escribed. It is produced by the adsorption of compounds of iron and lumina by colloids of the soil, which then give an acid reaction to litmus. n soils of this type free from humic acids, the acidity persists after leaching, ince it is insoluble ; but treatment with a solution of neutral salts, such as otassium chloride, potassium sulphate, potassium nitrate, sodium chloride, esults in the appearance in solution of free acid with the compounds of iron nd alumina. Since the salts of iron and alumina are adsorbed by the umic acids and other colloids of the soil and are set free again on treatment ith neutral salt solutions, these compounds must exercise considerable nfluence not only on the acidity of purely mineral soils, but also on that f soils containing humus.

The injurious action on vegetation of compounds of alumina and iron dsorbed by the soil colloids is due chiefly to the liberation of soluble acid alts of iron and alumina on the application of saline manures.

In Japan and Korea a large number of soils, making about three-quarers of the samples examined, show an acid reaction, due in more than alf the cases to compounds of alumina and iron. Soils of Mesozoic origin ave most often an acid reaction ; they are followed by the Tertiary, alaeozoic and Pleistocene, whilst alluvial soils show acidity only half as ften as the Mesozoic. Further, soils formed from so-called acid crystalline ocks show acidity in a larger number of cases than those from basic rocks, hile those formed from volcanic ashes still less frequently show acidity.

Litmus paper is the simplest means of determining qualitatively the cidity of a soil. More exact methods are those of Baumann and Gully nd of Loew. The writer proposes an equally exact and simpler method sing potassium nitrite. It consists of treating 5 gms. of soil in a test-tube ith a 10 per cent. solution of pure potassium nitrite, adding it drop by rop until the soil becomes thoroughly moist ; the test-tube is then closed ith a plug of cotton-wool, from which hangs a strip of starch-iodide aper ; after a certain time the degree of acidity of the soil can be deterined by the intensity of the blue coloration of the paper.

The property of liberating free acid from neutral salts possessed by the olloidal compounds of iron and alumina has suggested to the writer a ethod of determining quantitatively the acidity of soils by means of potasium chloride. For this 100 gms. of air-dried soil are treated with 250 cc. f normal potassium chloride solution in a retort of 600 cc. capacity during days, shaking it at intervals, or better placing it in a shaking machine for ne hour ; 125 cc. of the supernatant liquid are then taken and boiled ntil free from carbon dioxide, when it is titrated with a decinormal soluon of caustic soda, using phenolphthalein as indicator. A further 125 cc. f the potassium chloride solution is added and the titration repeated. This rocess is repeated until all the acidity has been determined. By determing the relation of the first titration to the total quantity of acid the method an be reduced to one operation ; the writer is preparing a formula for is. Tables are also given showing the quantity of limestone or quicklime ecessary to neutralize a given quantity of soil.

The above-mentioned acid soils are generally deficient in lime, th ratio of lime to magnesia being unfavourable to growth. These observation are summarized in the accompanying table.

Reaction of the soil and the ratio $\frac{lime}{magnesia}$

Reaction of Soil	Mineral acidity of Soil — cc. of $\frac{N}{10}$ NaOH	Cultivated Soils		Uncultivated Soils	
		No. of samples	Mean ratio $\frac{lime}{magnesia}$	No. of Samples	Mean rati $\frac{lime}{magnesia}$
Extremely acid	> 20	8	0.81	15	0.54
Very acid	20 — 5			20	0.65
Acid	5 — 1	13	0.88	11	0.96
Feeb'y acid	< 1	12	1.33	29	1.04

PERMANENT IMPROVEMENTS. DRAINAGE AND IRRIGATION

981 – **Irrigation in Spain.** — De La Rosa, Fernandez, in *Boletin de Agricultura tecni y economica, Direcion general de Agricultura, Minas y Montes*, Year VI, No 67, pp. 62 622. Madrid, July 31, 1914.

Except for the north-west of the Iberian peninsula where the rainfa is abundant and regular, almost the whole of Spain suffers from frequer drought or irregular rainfall. The problem of irrigation therefore pr sents itself and has been dealt with since the remotest times. Proof of th is found in the remains of hydraulic works of aboriginal tribes and of th Roman period, also in the irrigation canals constructed by the Arabs f watering the orchards of Valencia and Murcia and the rich plains whic extend from the mountain slopes in the districts of Malaga and Grenad and the regions bordering the Ebro. Later constructions are the gran canals of Urgel in Catalonia and Imperiale in Aragon, but it was onl at the end of last century that they were utilized to the full.

Three systems of irrigation are practised in Spain : 1) by means of *wel* from which the water is raised by wheels or more rarely mechanical pumps 2) *canals* fed by the large rivers by means of hydraulic wheels or dykes 3) *artificial lakes* (" pantanos ") which feed the irrigation canals. Preferen has been given to the collection of water in reservoirs, in place of the dire deviation of rivers, owing to the fact that during the winter rains th become devastating torrents, whilst during the summer the water is co siderably reduced and many rivers dry up. The total irrigated area is esti ated at 3 233 108 acres, of which about 200 000 acres are irrigated wi subsoil water. This area is distributed in the four great districts of Spa as follows :

Aragon and Navarre: The canals Imperiale, Tauste, Jalón, Galleg Huerva, and artificial lakes of San Bartolomé, and of Mezalocha in t province of Saragossa ; canal of Jaca, reservoirs of Huesca and Hijar,

gation canals from the Guadalaviar, the Jiloca and the Martin in the provinces of Teruel and Huesca ; artificial lakes of Grágera, Calahorra, and Cervera in the province of Logroño, and canals of the Rio Llano and Bayuriga in the province of Pamplona. The total irrigated area is 580 091 acres.

Catalonia: The canal of Urgel in the province of Lerida ; canals of Manresa, the Infanta and others fed by the Llobregat in the province of Barcelona ; numerous branches from the Ebro in the province of Taragon and the small reservoirs of Puigcerdá, Figueras, La Bisbal and Santa Coloma de Farmés in the province of Gerona ; in all about 472 920 acres irrigated.

Levante : Irrigation canal Real del Júcar de la Mayor and numerous others from the Turia and Palancia in the province of Valencia ; canals of Mijares, which fertilise the " Plana " in the province of Castellon ; artificial lakes of Tibi, Elche and Elda in the province of Alicante ; irrigation canals by filtration from the Segura, Guadalentin and Moratella, and artificial lakes of Puentes and the Val de Infierno in the province of Murcia: total 629 259 acres.

Boetic-Mediterranean region: The rivers Genil, Guadix, Dauro, Illora and Guadalfeo in the province of Grenada ; canals of Guadiaro and Genal, artificial lakes of San Pedro Alcantara and San Luis de Sabinillas, and the wells of Marbella in the province of Malaga ; numerous streams or small canals (" caceras ") from different watercourses in the province of Almeria ; in all 364 690 acres under irrigation.

The above sixteen provinces comprise about two-thirds of the irrigated area in Spain ; the other thirty-three provinces make up the remaining third.

Since 1900, the Government has initiated hydraulic works on a large scale and organised a special Department consisting of 10 divisions, for carrying out the numerous projects. The following works have been completed: artificial lakes at Mesalva (Teruel), Gragera (Logroño), Peña (Huesca), Gasset (Ciudad Real), Talava and Alphonso XIII (Albacete) and the Aragon and Catalonia canal.

The following are in course of construction: the artificial lakes of Cueva Foradada and Pena (Teruel), Toíx (Barcelona), Riudecañas (Tarragon), Guadalmellato (Cordova) and Guadalcacin (Cadiz). Amongst the numerous projects in course of discussion, the most important concern the artificial lake of the Ebro, the artificial lake of Cuerda del Pozo in Duero, and the irrigation of the lower valley of the Guadalquivir, in the provinces of Cordova and Seville. On the completion of these works during the next ten years, unless unexpected developments arise, over a million acres of land will be brought under irrigation. Nevertheless, the total area suitable for irrigation is at least 10 million acres, and it will require many generations before the irrigation requirements in this country are completed.

Artesian wells have been tried in some provinces for several years, but with only meagre results. Though satisfactory in certain parts of Levante, they were a complete failure in other parts of the southern region. The boring of these wells in the province of Leon was successful, especially on the Royal estate of El Pardo.

MANURES AND MANURING

982 – **Experiments with Bacterized Peat.** — *The Agricultural News*, Vol. XIII, No. 321, p. 263. Barbados, August 15, 1914.

Experiments have been made with a view to determining under English conditions the practical value of Professor BOTTOMLEY'S (1) bacterized peat.

One series was conducted in the open ground and the other on plants in pots and boxes. During the former a drought occurred which rendered it difficult to draw any conclusion as to the beneficial effect produced by bacterized peat.

But when artificial watering was adopted in order to compensate for the lack of rain, the favourable results were always evident. In one experiment with lettuces and radishes grown in ordinary garden soil and manured with different substances which included guano and bacterized peat, the results showed these two substances to be of about equal value.

But the most interesting series of trials and the one which seemed to show conclusively that bacterized peat is of value, was that in which radishes (96 per box) were grown in ordinary soil in boxes 1 yard square and treated as indicated in the following table:

	Roots		Tops		Total Weight	
	lb.	oz.	lb.	oz.	lb.	oz.
Control, two boxes, average	0	11	0	8 ½	1	3 ½
Farmyard manure, small dressing	0	12	0	12	1	8
Guano (½ oz. before sowing, and ½ oz. top dressing)	0	14	0	8 ½	1	6 ½
A well proved fertilizer, ½ oz. before sowing and ½ oz. top dressing	1	0	0	11	1	11
Nitrolin (3 oz. per box before sowing)	1	3	0	12	1	15
Bacterized peat (4 oz.)	1	8 ½	0	13 ½	2	6
Bacterized peat (8 oz.)	1	5	0	11	2	0

The result shows: 1) that bacterized peat is of high manurial value; 2) that it favours the development of both roots and tops (leaves) but especially the former; 3) that, as has been observed in other experiments, a lighter dressing of bacterized peat is somewhat more effective than a heavier one. Incidentally the experiment goes to show that nitrolin is a fertilizer which deserves a good trial on garden crops.

Bacterized peat used in the relatively small quantities in which it can be used effectively does not appear to exercise a beneficent action on the water-holding capacity of the soil; it has valuable manurial properties and these do not seem to be limited to the provision of nitrogen.

These experiments confirm the results reached by the earlier experiments at Kew and elsewhere.

(1) See No. 410, *B.* May 1914. (*Ed.*)

983 – **The New Potash Deposits in Spain.** — 1. Documentos parlamentarios, Criaderos de sales potásicas y otro minerales empleados como abonos ó que sirven para su fabricación. — *Boletin de Agricultura Técnica y Economica*, Year VI, No 68, pp. 739-743. Madrid, August 31, 1914. — 2. Editorials, Potash Supply. — *The Engineering and Mining Journal*, Vol. 98, No. 11, p. 497. New York, September 12, 1914. — 3. SCHMIDT, K. Die Kalilager in Katalonien. — *Zentralblatt für die Kunstdünger- Industrie*, Year XIX, No. 16, pp. 338-339. Mannheim, August 15, 1914.

1. — Following the announcement of the discovery of deposits of potash salts in Spain, the Minister of " Fomento" has presented a scheme for the regulation of their exploitation.

According to this report, the deposits in the neighbourhood of Suria and Cardona (prov. of Barcelona) give hope of considerable future development, as much by the area, depth and strength of the beds as by the quality of the minerals. Various companies have explored these deposits and have applied for concessions several thousands of acres in area, not only in the province of Barcelona but also in those of Gerona, Lérida and Huesca.

The Spanish Government, realizing the importance of the question, nominated a commission of the Geological Institute of Spain to undertake the necessary researches. This commission has issued a memoir confirming the favourable prospects of the discovery. Considering that the consumption of potash salts in Spain has reached the value of £149 270 (3 731 750 pesetas) and that it will increase considerably when the price is reduced, the Spanish Government considered it advisable to submit to Parliament measures concerning the exploitation of these discoveries, for the benefit of agriculture and national prosperity.

The first article of the law reads as follows :

" From the date of publication of this law all mining concessions for potash salts and other minerals employed as manures or for the fabrication of manures, including all minerals containing or capable of producing such substances, even though the concessions may have been granted under another denomination, are placed under state control with regard to the production and sale of the products obtained. The concessionaries must undertake to continue the prospecting and working of the concessions without interruption.

" The State reserves the right to regulate and change the manner of working in the interests of the public and to impose special conditions in the interests of the national consumption, such as the imposition of a tariff on exported products ".

2. — In confirmation of the above it is useful to note that amongst the most important of the concessionaries is an American firm, the " American Agricultural Chemical Co.", which has undertaken the working of some of these deposits. The last report of this company gave promise for the future and stated that the deposits resembled those in Germany.

3. — In this connection may be considered the communication of Professor Schmidt before the last meeting of the German Geological Society at Berlin and the discussion which followed.

The deposits of potash salts are found in the Tertiary strata of the Ebro basin, *i. e.* in the same region as the large mass of rock salt at Cardona

known since antiquity. The discovery was made by a small contractor who came across layers of carnallite and sylvine whilst boring in the neighbourhood of Cardona. Prospecting made up to the present shows that there is a deposit 260 ft. in thickness, containing 70 ft. of beds of carnallite with 20 per cent. potassium chloride, and 33 ft. of sylvine with 95 per cent. potassium chloride. Later explorations will establish the extent of these deposits. In origin they are analogous to those of Alsace, *i. e.* they are not primary formations resulting from the evaporation of seawater, but secondary formations derived from more ancient saline deposits, probably from Triassic saline deposits of the Pyrenees and the coast ranges of Catalonia.

984 – **Manuring Experiments with Manganese Carbonate in Italy.** (1) — D'Ippolito, G., in *L'Agricoltura moderna*, Year XX, No. 17, pp. 259-260. Milan, September 1-15, 1914.

Experiments with manganese carbonate were conducted on wheat and three-year-old lucerne. The latter crop, which had received a dressing of superphosphate and sulphate of potash at the end of the winter, was divided into two plots: one of 1370 sq. yds., manured on the 18th of March with 50.7 lbs. of natural manganese carbonate of 35 per cent. purity; and the other of 1292 sq. yds. with 48.5 lbs. of phospho-manganose (a natural rock containing 35 per cent. carbonate and 11 per cent. phosphoric acid). These amounts are equivalent to 180 lbs. per acre for each plot. A third plot of 1091 sq. yds. was used as a control.

The quantities of hay obtained in the first cut are as follows:

Plots	Yield of hay per acre
	cwt.
1 with phospho-manganose	61.9
2 » manganose alone	61.5
3 control	40.6

The succeeding cuts were damaged by rain and are omitted. The net profits of the manured plots over the unmanured were £1 8*s* 10*d* and £1 7*s* 11*d* per acre respectively.

The wheat was grown on broken-up lucerne ley manured with 535 lbs. per acre of basic slag. Two plots, each of 594 sq. yds., were chosen; 33 lbs. of natural manganese carbonate was applied to one and 35 lbs. of phospho-manganose to the other, making 267 lbs. per acre. A third plot of 566 sq. yds. was used as control. The variety Hybrid Unlodgeable was sown at the rate of 107 lbs. per acre.

The results at harvest were as follows:

Plots	Yield of grain
	bu. p. acre
1 with phospho-manganose	48.3
2 » manganose alone	41.1
3 control	31.3

(1) See also Nos. 226 and 266, *B.* March 1913. (*Ed.*)

The net profit of the manured over the unmanured plots was 11*s* 5*d* with phospho-manganose and £1 12*s* 9*d* with manganose.

These results show the importance of manganese to crops. The writer so remarks that no other of his 11 experimental plots, not even that with nitrate of soda, reached the yield of these manganese plots.

5 - **Comparative Morphology of Some Leguminosae.** — MARTIN, JOHN N., in *The Botanical Gazette*, Vol. LVIII, No. 2, pp. 156-167 + IV plates. Chicago, August 1914.

The writer carried out at the University of Chicago and at the Iowa State College microscopical investigations which enabled him to determine the process of development of the embryo-sac, embryo and endosperm of *Trifolium pratense, T. hybridum, T. repens, Medicago sativa* and *Vicia americana.*

In the course of his investigations the writers observed that the sterility of ovules is a prominent feature in *Trifolium pratense,* and this seems to be due to moisture conditions. Undoubtedly this tendency always lowers the percentage of seed production and in some cases reduces it almost to zero. The fact that this tendency varies among plants under similar conditions suggests that it may be partly eliminated by selection. The tendency toward sterility is not so pronounced in *T. hybridum* and is not much marked in *T. repens.* No sterility was observed in *Medicago sativa,* but all material used, so far, was collected during rather dry periods, and further investigation is necessary to determine the effect of moisture upon its fertility. In *Vicia americana* some sterile ovules were found, but the tendency toward sterility is not so pronounced as in the clovers. The literature cited includes fourteen works.

5 – **The Exchanges between the Plant and its Nutritive Solution.** — MAZÉ, P., in *Comptes rendus hebdomadaires des Séances de l'Académie des Sciences*, Vol. 159, No. 3, pp. 271-274. Paris, July 20, 1914.

In experiments on maize the writer has shown that the production of a given weight of vegetable tissue requires a constant volume of mineral solution of definite composition and concentration. He has further shown that the roots excrete mineral and organic matter (1). The present researches provide an experimental basis for studies on the function of osmosis in the absorption of nutritive substances by roots.

Maize plants were grown in aseptic mineral solutions containing 2 to 3 per cent. of saccharose. At the moment when the plants lost their turgescence in the sunshine owing to the increased concentration of sugar, the percentage of sugar was determined in the nutritive solution and in the sap of roots, stem and leaves. The results obtained showed that the nutritive solutions contained more sugar at the end of the experiment than at the beginning and that there is no relation between the sugar composition of the nutritive solution and that of the saps of the various parts of the plant. The exchanges between the plant and its nutritive solution are therefore in this case not subject solely to the laws of osmosis, but are rather sub-

(1) See No. 19, *B.* Jan. 1914. (*Ed.*).

ject to the chemical work of the plant. In order to reduce the respirator functions to a minimum, the plants were placed for 11 days in a positio facing north with diffused light of low intensity. In this case also analy sis showed that the nutritive solution contained more sugar at the end o the experiment than at the beginning and that the plant had consume some of its reserve sugar. The exchange between the root and the nutritiv solution is not therefore in accordance with the laws of osmosis.

In a medium containing excess of one or several ingredients, the root become impervious even to water. Considering that in the case of physio logical nutritive solutions colloidal organic bodies are absorbed, it follow that the function of absorption of the roots is one of filtration, the spee of which is determined by the chemical activity of the plant at any give moment.

987 – **The Influence of the Osmotic Pressure of the Soil Solution on the Growth o Spring Wheat.** — TOULAÏKOFF, N. (Director of the Experiment Station of Bésai tchouk, Russia), in *La Pédologie*, Year XV, No. 4, pp. 71-103. Petrograd, 1913.

Analyses of the nitrogen content of wheat grains in south-easter Russia show a slight increase in the nitrogen content of wheat from slightl saline soils. This fact had already been noticed by V. S. BOGDAN in hi work on the wheats of the district of Novoouzensk.

The higher protein content of wheat from south-east Russia wa formerly attributed to the low rainfall. This explanation is plausibl if the low rainfall accounts for the increased concentration of the soil solu tion. The writer was therefore led to study the physical, as distinct fro the physioolgical, effects of salts on the wheat plant , as in the earlies stage of development the germinating grain is subject more to the physica than to the chemical changes of its environment. As the swelling and germ ination of the grain depend chiefly upon the rapidity of absorption of th surrounding solution, it seemed advisable to begin by studying the in fluence of the osmotic pressure of salts on growth.

Experiments were made with the salts occurring in the region of Bé saintchouk, *viz.* NaCl, Na_2SO_4, etc. They were carried out durin 1910-13 in zinc vases containing about 11 lbs. of black soil (chernoziom) seed ed with the spring wheat Biélotourka. The necessary nutritive solutio was supplied in order to obtain the maximum yield of vegetable matte In the calculation of the osmotic pressure in the soil solution, the nutritiv matter already present in the soil and that added is omitted, as it woul not be possible to determine it by ordinary methods. However, since th same quantity of soil and manure was added to each pot, the osmot pressure of the soil solution may be considered the same in each case (abou 4 atmospheres) and left out of account. Therefore in speaking of 3, 5, 7 10 atmospheres of osmotic pressure, the figures refer to the increases osmotic pressure due to the non-nutritive salts added. The control po containing no non-nutritive salts were maintained at a constant osmot pressure of about 4 atmospheres by maintaining a constant humidity 60 per cent. of the maximum by means of daily spraying with distill water. Both nutritive and non-nutritive salts were added to the po

t the time of filling. The osmotic pressure of the solutions of non-nutrive salts was determined for the pure salts, and not their mixtures.

Experiments in 1910 *and* 1911. — These were only of a preliminary nature, to determine the suitable limits of osmotic pressure.

Experiments in 1912. — The following salts were used: sodium chloride, sodium sulphate, magnesium sulphate, sodium carbonate and ammonium nitrate. The first three were also used in mixtures of two and three. Ammonium nitrate was not used as a nutritive salt, but only to increase the osmotic pressure. The osmotic pressures compared were 0, 5, 7, 12 and 15 atmospheres.

Twelve sprouted grains of wheat were planted in each pot on the 13th of April. On the 18th, the control pots and those with a pressure of 5 atmospheres showed seedlings 5cm. high. The seedlings in pots of higher pressures were much shorter, but not so much in the case of ammonium nitrate. The plants in the control pot commenced tillering on the 24th of April, whilst the others did not begin before the 28th and 29th. They were thinned out on the 2nd of May, leaving only seven plants in each pot. The height of the plants was measured on the 15th and 29th of May and the 7th of June. It was found that during the first period of vegetation small quantities of salts stimulate the vegetative growth of wheat, but that later they retard it: towards the 3rd of June the control plants were higher than all the others.

Increase of osmotic pressure causes an appreciable diminution in the mean growth of the variety Biélotourka, though it hastens the appearance of the ear, the flowering and the ripening, thus shortening the vegetative period. Exception to this occurred in the ammonium nitrate pots, in which the phases were retarded and the vegetative period was longer even than in the controls.

As the plants reached maturity they were submitted to the following tests: length of ear, yield of total vegetable matter and of grain, weight of 1000 grains, percentage of nitrogen in grain, coefficient of transpiration (calculated). The data obtained showed that increase of osmotic pressure diminishes the yield of total vegetable matter and grain, the length of ear and the weight of 1000 grains, whilst it increases the percentage of nitrogen in the grain even in soils rich in nitrogenous matter.

Experiments in 1913. — The maximum osmotic pressure was reduced from 15 to 12 atmospheres and for every salt experimented with two additional pots with an osmotic pressure of 3 atmospheres were added. Since the experiments of 1912 had shown that the salts of the soil solution cannot be considered as merely increasing the osmotic pressure, but as exercising also other influences, physical, physiological, etc., it was considered advisable to increase the number of salts under experiment. The following salts were therefore used: sodium chloride, ammonium chloride, calcium chloride, magnesium chloride, sodium sulphate, ammonium sulphate, magnesium sulphate, sodium nitrate, ammonium nitrate.

The results obtained are summarised in the Table below, which shows clearly the existence of a stimulating action of all salts when the osmotic

pressure reaches 3 atmospheres. At this pressure, under 1913 conditions the coefficient of transpiration of Biélotourka was lowered, while the total yield and the yield of grain were increased, although the weight of 1000 grains was decreased by 1.1 gm. from that of the controls.

Mean results of 1913 *experiments.*

Osmotic pressure of soil solution	Water evaporated, gms.	Coeff. of transpiration	Total yields, gms.	Yield of grain, gms.	Weight of 1000 grains, gms.	Nitrogen content of grain, %
Normal	15 622 (maximum)	314.2 (minimum)	48.2 (maximum)	18.71 (maximum)	38.27	2.068
» + 3 atmospheres	16 156	291.5	55.44	22.43	37.14	2.283
» + 5 »	11 503	307.2	38.37	15.16	33.70	2.931
» + 7 »	9 207	362.5	29.72	10.15	24.04	3.564
» + 10 »	5 998	418.9	17.48	4.46	23.13	3.885
» + 12 »	3 494	630.7	7.30	2.72	22.47	—

An increase of osmotic pressure above 3 atmospheres caused a decrease in the yield of grain and in the 1000-grain weight, as well as a less efficient utilisation of the soil moisture, assuming that the coefficient of evaporation increases proportionally to the increase in osmotic pressure. On the other hand an increase of osmotic pressure caused an increase in the percentage of nitrogen in the grain and in the flintiness, but a decrease in the percentage of starch.

Action of different salts and their elements.

A. *Acids.* — 1) At an osmotic pressure of 3 atmospheres the maxima of total yield and yield of grain are obtained from nitrates, which are followed by sulphates and then by chlorides.

2) At 5 atmospheres the highest yields are given by the sulphates, followed by chlorides with respect to grain and nitrates for still less grain.

3) At 7 atmospheres, the yield is better with sulphates than with nitrates.

B. *Bases.* — At 3 and 5 atmospheres ammonium salts give the largest increase of total yield and of grain yield, as well as the largest percentage of nitrogen in the grain. In respect to yield the salts of magnesium come second and those of sodium third. In respect to percentage of nitrogen, sodium salts come second and magnesium salts third.

Conclusions. — 1) The character of the soil solution, especially its concentration and osmotic pressure, have a distinct influence on the vital functions of spring wheat. Increase of osmotic pressure at first stimulates growth, then beyond an optimum limit of 3 atmospheres, whatever the salt, it has a depressing influence on growth, but at the same time increases the percentage of nitrogenous matter in the grain.

2) Under certain meteorological conditions, a very pronounced stimulating action on the wheat plant can be obtained by bringing the osmotic pres-

sure up to the optimum, irrespective of the salt used. This results in a greater yield of straw and grain, a better quality of grain, a higher nitrogen content and a more efficient utilisation of the soil moisture by the plant.

3) The presence of nitrogen in solution, either as base or acid, appreciably increases the yield of straw and grain as well as the percentage of nitrogen in the grain, compared with non-nitrogenous salts. Of the latter, sulphates have a greater influence on yield than chlorides.

988 – **The Action of Various Electrolytes on the Grains of *Avena sativa*.** — PLATE, F., in *Annali di Botanica*, Vol. XII, Part 3, pp. 261-343. Rome, May 1914.

These researches concern the stimulating effect of chemical agents on the imbibition of grains of *Avena sativa*.

It is well known that seeds are able to resist injury from solutions of salts up to a certain concentration and that such solutions exert an influence on the subsequent development of the embryo and seedling. In these experiments the effect of the different ions of acids, bases and salts was investigated. The strengths of the solutions used were N, $\frac{N}{2}$, $\frac{N}{5}$, $\frac{N}{10}$, and the period allowed for absorption was 2 hours. The increase in weight of the seed was determined at intervals of half an hour. Observations were made of substances which accelerate or retard germination and on the effect of imbibition on the external morphological characters of the seedlings with special reference to the size of the shoot and root, and the fresh and dry weight of the seedling. The quantities of salt absorbed were determined by weighing and also in parallel series of experiments by analysis of the liquid remaining after each period.

From these results the writer concludes that immersion for only two hours exerts an influence in many cases not only on the physico-chemical phenomena of imbibition, but also on the subsequent development of the seedlings. The absorption of distilled water or tapwater varies within near limits according to the individuality of each grain, but generally it increases rapidly during the first stage of immersion, continues more steadily during the second stage and decreases slowly during the third stage until it ceases completely. The beginning of imbibition and the quantity of water absorbed vary with different grains, with different solutions and according to the concentration. These experiments confirm the conclusion that during imbibition, seeds absorb more proportionally of the solvent than of the electrolyte, so that the solution becomes more concentrated after immersion.

Classified according to their effect on imbibition the substances are grouped as follows :

1) Substances not absorbed and having no influence on imbibition : the chlorides of sodium, potassium, calcium, barium and zinc ; bromides of sodium and potassium; nitrates of potassium, barium, cadmium and silver ; sulphates of potassium, cadmium and copper; formate, acetate, and oxalate of potassium.

2) Substances absorbed without influencing the total amount of liquid absorbed under normal conditions : the chlorides of cobalt and iron.

3) Substances which, though not absorbed, diminish considerably the imbibition : acid phosphates of sodium and potassium, sulphates of aluminium, chromium and iron.

4) Substances which, though not absorbed by the seeds, not only diminish the imbibition but also influence the germination : ferrocyanide, permanganate and bichromate of potassium ; the alums of potassium, chromium and iron; the nitrites of sodium and cobalt; the chlorides of cerium, tin, cadmium and mercury ; bromide of mercury.

5) Substances which are absorbed and diminish the imbibition, as well as affecting germination : iodides of cadmium, sodium, potassium, and the nitrates of mercury and cobalt.

6) Substances absorbed, increasing the imbibition and also favouring the germination : formic, acetic, oxalic, nitric, sulphuric and phosphoric acids.

7) Substances not absorbed, but accelerating imbibition and to a considerable extent promoting germination : malic, citric, tartaric and hydrochloric acids.

Excluded from this list are the hydrates of the alkalis and alkaline-earths, which in the concentrations used were fatal to the grains.

It follows from these results that substances which are absorbed for a period of two hours, do not penetrate throughout the seed, but are arrested at the testa. It remains to be determined if they will penetrate further if imbibition is prolonged.

Malic, citric and tartaric acids are most favourable to growth, though they are not absorbed by seeds. This is explained by supposing that some indeterminable trace of acid acts on the seeds catalytically and causes a greater acceleration of the physico-chemical processes.

These researches support the conclusion that the laws of absorption are not constant for all solutions and concentrations, but that specific coefficients of absorption should be attributed to each cation or anion.

The specific actions of hydrogen ions and hydroxyl ions have considerable biological importance, and it is probable that the carboxyl group is not less important.

989 – **Effect of High Frequency Currents on Plants.** — HOMBERGER, ERNST, in *Die Umschau*, Year XVIII, No. 36, pp. 733-735 + 2 figs. Frankfurt-on-the-Main, September 5, 1914.

The writer recalls the observations of Lemström, who attributed the greater rapidity of growth in polar regions to the higher potential of atmospheric electricity, and the experiments in electroculture carried out by Lemström, Lodge and others. While the use of high tension continuous and alternating currents led directly to the soil and to the plants was always connected with injury to the latter as soon as the intensity of the current exceeded certain limits, this injury was no longer observed when alternating high frequency and high tension currents were employed.

Experiments of this kind were recently conducted in the Moräne farm near Dayton in the United States. Several experimental plots were sown with radishes and salad. After they had sprouted the electric current was started.

One plot was subjected to the action of high frequency currents which passed through a wire stretched at about 16 inches above the soil. The difference of potential between the soil and the conductors was about 10 000 volts; the frequency was of 200 000 periods per second generated by Tesla currents. The passage of the current lasted one hour in the morning and one hour in the afternoon. The growth of the salad compared to that of the check plot was increased by about 75 per cent.

Alternating high frequency currents are biologically harmless to plants, animals and man. Arsonval introduced them into therapeutics. On transforming high tension into high frequency, diathermic currents are obtained with which heat can be produced in the deep strata of animal tissues. With the diathermic apparatus the human body can be traversed without danger by currents of an intensity somewhat over 1 ampère; only if the intensity be too much increased does combustion take place.

The writer experimented upon plants with such an apparatus; he placed the two electrodes in flower-pots with plants between them. Most of the experiments were carried out with beans, and they regularly showed that the stem grew thicker and the leaves larger than in the check plants. During the experiments three treatments per day were made; as soon as the temperature reached 35° C. the current was interrupted. The length of time that the soil retained the heat was remarkable and still more so the fact that the stem and the leaves formed a greater quantity of chlorophyll than those of the check plants.

In order to determine whether the greater intensity of growth was due to the heat or to the high tension of the electromagnetic field, the writer treated other plants of beans with Tesla's currents (that is high tension and high frequency). The effect of one such treatment lasting 5 minutes was very evident and proved that the stimulus to growth is due to the oscillating field and not to heat. The greater formation of chlorophyll in the treated plants is perhaps due to the fact that under the influence of the oscillating electro-magnetic field chemical decompositions take place in which large molecules take part; these decompositions are similar to those caused by the catalytic action of the still more rapid luminous vibrations.

990 – **Influence of X-Rays on Vegetation.** — MIÈGE, EM., and COUPÉ, H., in *Comptes Rendus hebdomadaires des Séances de l'Académie des Sciences*, Vol. 159, No. 4, pp. 338-340. Paris, July 27, 1914.

Experiments were made on *Raphanus sativus* and *Lepidium sativum*. Ten seeds were sown in each of a number of pots of garden soil and covered with half an inch of leaf-mould. The pots were then subjected to the action of the rays; the frequency and the intensity of the radiations varied in the nine groups that were made. Differences began to appear on the 22nd day; the experiment terminated on the 38th day.

From the results of these preliminary experiments the writers conclude:

1. That X-rays exert a clearly favourable action on the vegetation of both *Raphanus* and *Lepidium*, as shown by the increase of weight, which attains in *Raphanus* 45 per cent. for the leaves, 59 per cent. for the whole plant and 193 per cent. for the bulb.

2. — That this benefit is all the more marked the more frequent and intense the radiations, also when they attain an intensity (75 H. per month) which would render them decidedly injurious to animal tissues.

3. That X-rays have a slight reaction on the morphology and anatomical structure of the plants under consideration (in general the vascular and supporting tissues are more developed and better differentiated).

991 – **A Study on the Germinating Power of Seeds.** — DARSIE, MARVIN L., ELLIOTT, CHARLOTTE, and PEIRCE, GEORGE J., in *The Botanical Gazette*, Vol. LVIII, No. 2, pp. 101-136 + 18 figs. and diagrams. Chicago, August 1914.

Until recently the tests of the longevity or viability of seeds have depended upon the percentages of actual germination in prepared beds. Such tests are simple enough in the case of seeds which germinate quickly and in these cannot be improved upon. When, however, two weeks or more must elapse even under most favourable conditions before one may know the quality, that is the germinating power, of the seeds, a quicker method is desirable, also because in briefer exposure there is less danger of injury or loss from fungus or other enemies. Mr. G. J. Peirce has shown that by using silvered Dewar flasks as calorimeters one may quickly determine that heat is evolved in the germination of seeds and has suggested that there may be such differences in the heats liberated by seeds of different ages that they may be used as indicators of age and germinating power or viability.

Some experiments were undertaken in order to test this idea.

The germination experiments were made in silvered Dewar flasks and in seed beds with seeds of barley, clover, maize (Cory sweet corn), hemp, oats and wheat of different and well known ages. The results show that, other conditions being equal, a high temperature within a reasonable time is indicative of high germinating power, and also of the ability to make a rapid growth of root and shoot after germination, in other words of vigour. With the increase of the age of the seeds the quantity of heat produced diminishes, but of course such decrease is not always perfectly regular, owing to the different climatic conditions under which the seed was grown and harvested, to its degree of maturity and to the conditions of storage. Each species of plant that was studied appears to have, like the higher animals, a " normal " or characteristic temperature, departures from which indicate deviations from the best conditions of the organism. Other conditions being equal the " normal " temperature is evolved by the freshest and most vigorous seed : a higher temperature generally indicates an infection (fungoid) ; a subnormal temperature on the other hand denotes lessened vigour, generally due to increased age.

The " normal " temperature, or average daily heat yield in terms of 10 grams of seed, is 1.82° C. for hemp, 0.75° C. for clover, 0.73° C. for wheat, 0.55° C. for oats and 0.49° C. for maize.

PLANT BREEDING

992 **Selection of Cocksfoot *(Dactylis glomerata)* in New Zealand.** — HILL, W. S., in *The Journal of Agriculture*, Vol. VIII, No. 3 pp. 262-265 + 2 figs. Wellington, 1914

Cocksfoot is one of the most widely distributed and most useful grasses of New Zealand. Its seeds, especially those from the Banks peninsula,

upply a lucrative export trade to Europe. This plant, however, being so videly distributed and growing in the most different environments, pre- ents a number of types and variations. It has been found that the varia- ions in cocksfoot apply not only to the form of the panicle, but also to the quantity, quality, shape and colour of the leafage, to the height, to the degree of rust resistance, to the earliness of maturity, to the yield of seed, etc.

Consequently at the Moumahaki Experiment Farm a work of selection has been started with the aim of producing plants with abundant and good foliage and with a high resistance to rust. Plants exhibiting these desired points to a greater or less extent have been isolated, and the reproduction of selected types is being effected by vegetative or clonal reproduction, by inbred seed and by open fertilized seed.

993 – **Mutation in Egyptian Cotton.** — KEARNEY, THOMAS H. (Physiologist in Charge, Alkali and Drought Resistant Plant Investigations, Bureau of Plant Industries) in *Journal of Agricultural Research*, Vol. II, No. 4, pp. 287-302 + IX plates. Washington, July 1914.

The writer summarises as follows the facts that he has ascertained from the literature on the subject and from the observations made by him during his work of selecting cotton in Arizona.

The origin of the Egyptian type of cotton is obscure. According to one theory, it is a product of hybridization between a brown-linted tree cotton and American Sea Island, both of these types having been cultivated in Egypt nearly a century ago. Whether this be true or not, there can be no question that the varieties now grown are of mixed ancestry, a condition which some investigators regard as favourable to mutation.

Numerous varieties have appeared from time to time in Egypt. The Ashmuni variety, now grown only in Upper Egypt, originated about 1850. This variety gave rise in 1887 to the Mit Afifi, and from the latter the Abassi, Yannovitch, Nubari, Sakellaridis and Assil varieties have successively been developed.

As grown in Arizona from imported seed, most of the Egyptian varieties are readily distinguishable by the habit of the plants and by the characters of the leaves, involucres and bolls, as well as by the fibre.

So far as the scanty evidence goes, each of these varieties originated with a mutant, *i. e.* an individual plant which showed an abrupt and definite change in the characters expressed. This conclusion is supported by the more complete data at hand regarding the history of the varieties which have been developed in Arizona.

Plant breeding work in Arizona was begun 12 years ago with imported seed of the Mit Afifi variety. Persistent selection of the best plants caused some improvemet in earliness and productiveness and in the quality of the fibre, but the progress was not very substantial prior to 1908, in which year two types very different from the Mit Afifi were recognized and isolated. One of these was the Yuma variety, now commercially grown in Arizona. This form has continued to express its distinctive characters with a high degree of uniformity, notwithstanding the fact that the parent individual and its immediate progeny were not protected against cross pollination.

Two additional varieties described in this paper under the names "Pima" and "Gila" have lately been developed in Arizona. The Pima variety appeared as a single plant of marked individuality in a field of Yuma cotton at Sacaton, Arizona, in 1910. Its characters have been expressed in its progeny with great uniformity during the three subsequent generations. This variety is easily distinguished from the parent Yuma variety by its relative limblessness and by the correlated retention of the lowest fruiting branches and bolls; by the more uniformly deeply 5-lobed leaves; by the shorter, relatively wider, and nearly separate involucral bracts; by the plumper and more abruptly and sharply pointed bolls and by the longer fibre (average length of fibre: Yuma 1 ½ inch; Pima 1 $^{5}/_{8}$ to 1 $^{3}/_{4}$ in.; Gila 1 $^{7}/_{16}$ in.).

The Gila variety is derived from a single plant discovered by Mr. E. W. Hudson in a field of the Mit Afifi stock grown at Sacaton, Arizona, in 1908. In its external characters this type resembles the parent Mit Afifi variety much more than the Yuma, but differs in its earlier ripening, smaller vegetative branches, greater productiveness and longer fibre.

The individuality of the parent plant, together with the uniformity shown by its progeny during the subsequent generations, indicates that the Gila variety, like the Yuma and the Pima, is of mutational origin.

Egyptian cotton exhibits, although in a minor degree, the tendency to develop new varieties by mutation which characterizes *Oenothera Lamarckiana*. There is a further parallel in the fact that in both cases very similar, if not identical, new characters come into expression at different times and in different places. An example of this phenomenon in Egyptian cotton is afforded by the Nubari and the Yuma varieties.

If the tendency to produce mutants is a result of remote or complex hybridization, the mutability of Egyptian cotton might be accounted for upon either of the following grounds: 1) the supposed hybrid origin of the type as a whole, or 2) later crossing with other types of cotton.

Ever since mutation became recognized as a factor in the breeding of Egyptian cotton the following methods have been followed in Arizona: 1) recognition and isolation of desirable mutants; 2) selection and comparison on the progeny-row basis of those individuals among their progeny which express most fully the desirable characters of the new type; 3) elimination from the seed increase fields, preferably before blossoming begins, of the aberrant and otherwise undesirable individuals.

The bibliography of the literature cited comprises 21 works.

CEREAL AND PULSE CROPS

994 - **New Varieties of Wheat and Oats in New South Wales.** — PRIDHAM, J. T., in *The Agricultural Gazette of New South Wales*, Vol. XXV, Part 3, pp. 230-233 + 3 figs., p. 236 + 2 plates. Sydney, March 1914.

Varieties of wheat. — The new varieties of wheat obtained or imported by the Department of Agriculture are grown in the stud plots and compared with the standard varieties to determine their yielding qualities and their defects and good points. A sample of any variety found promising in the field is sent to the Departmental Chemist to be milled, and is recommended

o farmers if it yields a satisfactory flour; if it fails in this respect it is not ncluded among the list of varieties recommended.

In 1913 two varieties, "Bomen" and "Sunset", were recommended or further trial and they have fully justified that recommendation. Other wo varieties, "Canberra" and "Nardoo", are suggested for further trials at the Experiment Farms. The writer describes these four varieties. "Bomen" is awnless and bunt-resistant; in its pedigree it includes an Indian variety "Zaff", one from Manitoba, "Power's Fife" and two Australian wheats. "Sunset" is also awnless; it is intermediate between the medium strong and weak flour classes, and is very early. "Canberra" is slightly awned at the tip; it is a cross between Federation (the dam), and Volga barley, a two-rowed sort; it has yielded well and gives a high percentage of flour which is of excellent colour and belongs to the medium strong class. "Nardoo" is awnless, medium horny; it is decidedly smut-resistant and an excellent hay wheat; it is a hybrid of several varieties, including "White Naples".

Varieties of oats. — Among the oats recommended for further trials at the Experiment Farms by the recent Departmental Conference are "Sunrise" and "Guyra". "Sunrise" is a natural cross bred from Algerian oats, which it surpasses in length of straw by about a foot, and in earliness by a week; it is recommended for the warmer districts. "Guyra" is a cross between "Algerian" and "White Ligovo"; it stools very fairly and its grain is plump; it is suited to typical oat districts.

995 – **The Effect of Ammonium Salts on the Tillering of Wheat.** — WILD, L. J., in *The Journal of Agriculture*, Vol. IX, No. 1, pp. 31-32. Wellington, N. Z., July 1914.

This experiment was suggested by a statement in Dr. Griffith's "Treatise on Manures", to the effect that treating the seed wheat with a solution of sulphate of ammonia gives an increase in the number of stems produced by the individual plant. Five varieties of wheat were treated with nitrate of ammonia and three with sulphate of ammonia in 3 per cent. solution, and sown in plots of from 10 to 15 square yards in area. Check plots were also sown with untreated seed. No difference was noticed between the treated and untreated plots as regards rate of germination or rate of subsequent growth. When the grain was in ear twenty plants were taken at random from each plot and the average of stalks per plant was determined. The results were as shown in the accompanying table.

These results show that nitrate of ammonia is more effective than the sulphate in increasing the tillering power of wheat and point to the desirability of investigation on a more extensive scale.

Variety	Average tillering power		Increase	Percentage increase
	Treated	Untreated		
Varieties treated with sulphate of ammonia				
Hunter's White	7.5	6.4	1.1	16.7
King's White	6.5	5.6	0.9	16.0
Bordier	12.4	11.4	1.0	8.8
Totals	26.4	23.4	3.0	Average 12.8
Varieties treated with nitrate of ammonia.				
Red Tuscan	10.5	10.0	0.5	5.0
Solid Straw Tuscan.	10.1	7.6	2.5	33.0
White Tuscan	8.3	6.7	1.6	23.9
Glynus	7.0	6.3	0.7	11.1
Pearl	8.0	5.8	2.2	37.9
Totals	43.9	36.4	7.5	Average 20.6

ROOT CROPS

996 – **New Blight-proof Variety of Potatoes.** — *Queensland Agricultural Journal*, Vol. II, Part 2, pp. 103-106. Brisbane, August 1914.

A new variety of potatoes called the "New Era" has been obtained by a farmer who is also a keen student and observer, Mr J. G. Harris, of Raetihi, New Zealand. In the locality in which the potato was produced it has proved blight and frost proof; it is suitable to grow for the early potato trade and, it is stated, has produced up to 20 tons per acre.

The origin of this potato is as follows: six years ago Mr. Harris had an acre and a half in potatoes, Eldorados and Northern Stars. The potato blight swept the whole crop with the exception of one plant. Its tubers were multiplied during the next five years, and proved resistant to blight, while the above-mentioned varieties, as well as Irish Rock, Up-to-date and Gamekeeper (1), were all attacked.

FORAGE CROPS. MEADOWS AND PASTURES

997 – **Grasses at Hawkesbury Agricultural College, New South Wales.** — BREAKWELL, E. (Agrostologist) in *The Agricultural Gazette of New South Wales*, Vol. XXV, Part 8, pp. 653-656 + 11 figs. Sydney, August 1914.

Although the soil at Hawkesbury Agricultural College is not of a good character there are many grasses which stand the adverse conditions remarkably well.

The principal of these are: *Eragrostis leptostachya* Steud. (Paddock Love-grass), a native grass, particularly adapted to soils of a light or sandy nature; it is a heavy seeder and the seeds appear capable of

(1) See also No. 791, *B.* August 1914. (*Ed.*)

y germination. *Eragrostis curvula* and *E. curvula* var. *valida* have n recently introduced from America and are particularly adapted growing under adverse conditions, such as light soils and low rainfall; y produce, however, a coarse fodder. The latter of the two has a thick wth about 3 feet high and seeds heavily.

Andropogon intermedius (Blue grass). This is a native grass; its habitat n alluvial formations or on moist black soils in general; nevertheless ppears particularly adapted to the poor soil of the College. The grass heavy seeder, but so far the seed has not germinated very well; on other hand root planting has been very successful. It yields a heavy culent flag, which remains green from September well into May. It ery sensitive to frosts. At the College it is often attacked by a fungus *rebella* sp.).

Poa arachnifera (Texas Blue grass), is the most vigorous of the as and appears well adapted to the light soils. Propagation by seed ncertain, but it readily spreads if root planting is resorted to.

Poa pratensis (Kentucky Blue grass). — It quickly covers the ground. the College it suffers very much in the summer.

Poa sempervirens (Evergreen-Meadow grass). — This grass is really ariety of *Poa nemoralis*; it remains perfectly green during the heaviest frosts, and it grows fairly vigorously during the colder months of the r. Its texture is also finer than that of most of the other Poas.

Poa compressa. — Although this grass produces only a small quantity foliage, it is very nutritive and remains green during the greatest part the year. Its vigour at the College shows its adaptability to poor s, and its capability of enduring a limited rainfall is shown by its per-nent character at the Cowra Experiment Farm.

Pollinia fulva (Sugar grass). — A native grass; its flag is very succu-t and it is particularly drought resistant; it will also stand a large amount feeding off. At Hawkesbury, however, the production of seed has been newhat disappointing.

Bromus inermis (Awnless Brome grass). — This is a native of Europe, d a grass which has met with great success in the United States of Ame-a. It remains green the greater part of the year and stands the summer ter than *Bromus unioloides*. It is very nutritive and stands grazing well.

Bromus unioloides (Prairie grass) . — A very succulent grass, which duces a large quantity of feed during the cooler months of the year. der cultivation it yields heavily, and when cut for hay the new plants ing from the old root, becoming perennial in habit; but when stocked lisappears rather suddenly, behaving as an annual.

Bromus pumpellianus. — This is one of the newer bromes. It has far made a promising growth, while *B. sterilis*, *B. maximus* and *B. mollis* ve proved useless.

Chloris gayana (Rhodes grass). — Having already proved successful, cultivation of this grass has spread rapidly; for producing the quickest wth on the lighter soils, it appears to have no equal. It seeds heavily.

Chloris barbata (Australian Rhodes grass), *Paspalum dilatatum* a *Setaria nigrirostris*, which has given good results in the Transval; at t College it has grown vigorously, while at the same time its flag does become coarse.

Phalaris bulbosa is one of the best winter grasses introduced at t College.

Festuca elatior does well on the poor soils of the College and star the dry summers fairly well.

F. arundinacea is largely cultivated in New Zealand.

F. ovina, *F. rubra*, and *F. duriuscula*. — All these grasses will gr in light soils, but they have finer leaves and smaller growth than the t previously named.

998 – **Senegal Perennial Rice** (1) **as Forage.** — WOOD, C. E. (Manager, Kamerunga St Nursery) in *Queensland Agricultural Journal*, Vol. II, Part 2, pp. 154-157 + 5 f Brisbane, August 1914.

Mention having been made of the existence of a perennial rice in S negal, French West Africa, the Queensland Department of Agricultu procured a small parcel of seed which was tried at the Kamerunga Sta Nursery. The germination of a parcel of seed received in 1913 w fairly good; planted out in the open in January it was in flower by t end of May.

Perennial rice is a good forage, relished when green by cattle and hors and it also yields a good hay. It has, however, the drawback of produci only a very limited quantity of seed. The panicles are few and bear fr two to ten grains, the other glumes being empty. Owing to the scarci and leanness of the grain it is not likely to be of any use for human consum tion in its present form in Queensland.

999 – **Drought-resistant Grasses and Fodder Plants.** — BREAKWELL, B. A., in *Agricultural Gazette of New South Wales*, Vol. XXV, Part 5, pp. 385-386. Sydney, 19

The exceptionally dry summer through which the interior of New Sou Wales has just passed provided a good opportunity of investigating th plants which best endured the drought.

It was observed that of the plants growing in the Experiment Farm the following, tabulated in order of drought resistance, were the most p minent grasses : *Panicum bulbosum* (Experiment Farms at Wagga, Bathu and Cowra), introduced from America.

Panicum prolutum — Coolah grass (Wagga, Bathurst, Nyngan), nati
Andropogon bombycinus — Silky heads (Wagga).
A. intermedius — Rare blue grass (Cowra and Nyngan).
A. erianthoides — Satin top grass (Cowra).
Panicum floridum — (Cowra, Bathurst and Wagga).
Chloris gayana (Wagga, Nyngan and Cowra).
Poa arachnifera — Texas blue grass (Cowra and Bathurst).

(1) See No. 802, *B.* March 1911. (*Ed.*)

Other fodder plants:

Medicago media — Sand lucerne (Wagga and Nyngan). This lucerne ginated as a cross between the yellow-flowered lucerne (*Medicago falcata*) l the common lucerne (*M. sativa*), and in power of drought resistance ibits the characteristics of the former. It also differs from the ordinary erne in having a procumbent growth; this renders it more suitable for ture than for hay, but makes it a poorer seeder than Tamworth lucerne.

Poterium Sanguisorba — Sheeps' burnet (Wagga).

Vicia dasycarpa — (Bathurst).

o - **Cowpeas (*Vigna catjang* Endl.; *Vigna unguiculata* Walp.) in New South Wales.** — HADFIELD, J. W. (Instructor in Agriculture, Hawkesbury Agricultural College) in *The Agricultural Gazette of New South Wales*, Vol. XXV, Part 8, pp. 657-661+2 plates. Sydney, August 1914.

The cultivation of cowpeas is spreading from year to year in New uth Wales, where it began to become general between 1890 and 1892. its early development the Department of Agriculture cooperated by tributing large quantities of seed in small lots. It is now distributed nearly all the warmer parts of the State, though the production of seed still largely confined to the North Coast District.

As a rule the crop is sown in rows 2 ft. 6 in. to 3 ft. apart and the seed m 6 to 9 in. apart in the rows. This enables the crop to be cultivated. wing with a drill is much better than broadcasting and harrowing in, if in this case heavy rain falls a quantity of seed may become exposed d does not germinate. As with other legumes, nodules form on the ots of cowpeas, whence frequently the second and successive crops succeed tter than the first, and but rarely require nitrogenous manures of any nd. In manurial trials at the Hawkesbury College phosphoric acid was oved to be the most important manurial ingredient. Sulphate of potash, ough it increased the yields, was too expensive, while nitrate of soda and lphate of ammonia were decidedly detrimental, reducing the yield to e half that of the unmanured plots.

The varieties of cowpeas are very numerous. The Black is the most pular, while the Poona, a variety introduced from India, has rivalled it does not excel the Black at the College in the production of green fod- r; but when grown for seed it does not ripen its pods so evenly. Both e late maturing, while the White or Black Eye and the Upright-growing e early; the Iron is a mid-season variety and it is claimed to be immune m the attacks of eelworms.

Cowpeas form a very valuable green manure crop for orchard and gen- al farm work, though it is difficult to plough the vines in. At Hawkes- ry it is usual to roll the crop first, and then after running over it with a sk cultivator to plough it in with a single-furrow disk plough. The crop ould be ploughed in soon after the pods are set, as at a later stage the ems become woody. Considering its very high feeding value, the writer nsiders ploughing in the whole crop as being sometimes a very wasteful actice. If the crop be fed off on the ground where it is grown, at least

50 to 75 per cent. of the manurial value will be returned, while the full feeding value of the crop will also have been obtained.

As fodder crop, cowpeas give a better balanced and somewhat more abundant fodder when they are grown with maize, or still better sorghum and millet.

A system that has proved very profitable on the North Coast is to sow the cowpeas down between the rows of early corn. They are sown with a maize dropper immediately after the last cultivation of the corn, which should be not later than January if it is intended to harvest the cowpeas for seed. Yields of 10 bushels per acre are quite common, and sometimes even 16 bushels.

Cowpeas by themselves usually form an inferior kind of silage, often acid in character and poor in colour and smell, and more or less decomposed. They are much better when mixed with sorghum, maize or millet. American experience indicates that the best plan is to broadcast the cowpeas at one bushel per acre, and the sorghum or kaffir corn at about 10 lb. of seed per acre.

If cowpeas have to be cut and turned into hay a difficulty is met with, as there is no satisfactorily rapid method of harvesting. Machinery for the purpose has been devised, but hitherto without much success. Cowpea makes good hay, but its leaves fall very readily when dry and without the greatest care the loss will be considerable. The upright-growing varieties, such as Poona and Upright-growing, especially when grown thickly, can be harvested with a scythe and sometimes with a mower.

No machinery for the purpose of harvesting the pods has been perfected, and with present methods the whole plant has to be harvested and threshed, or the pods picked by hand. Three cwt. of these peas in the pod give, when threshed, one bag of peas weighing 240 lb.

The sale prices of cowpeas in New South Wales have been practically stationary during the last twenty years, namely, for the Black cowpeas about 10*s* per bushel on the Rivers and about 12*s* 6*d*. delivered at Sydney to seedsmen. The average retail price for cowpea seed is about 15*s* per bushel. The price of Poona, which has a very small seed, is usually something over £1 per bushel.

FIBRE CROPS

1001 – **Flax Experiments in Ireland.** — *Department of Agriculture and Technical Instruction for Ireland, Journal*, Vol. XIV, No. 3, pp. 515-534. Dublin, 1914.

Manurial experiments. — The following is a summary of the results obtained from the two series of experiments conducted by the Department during the eight years 1901 to 1908 inclusive:

1. The use of potash manures gave profitable increases; kainit and chloride of potash showed almost equal merits, were more regular in their effects and, on the average, gave better results than sulphate of potash.

2. The application of kainit and chloride of potash in winter gave results as good as when these manures were applied at the time of sowing.

(1) See also No. 825, *B.* March 1914. (*Ed.*)

3. Phosphatic manures, when applied either singly or in combination with a potash manure, or as part of a complete mixture, encouraged the growth of weeds at the expense of the flax, and their use was almost invariably attended with a loss, and very frequently even with smaller yields of scutched flax.

4. In some seasons profitable increases were obtained from the addition of the nitrogenous manure, rape meal, to kainit. Its effects, which appeared to depend on the nature of the season, were too irregular to warrant the general adoption of such a mixture in preference to the kainit or chloride of potash dressings now so commonly used.

5. The application of agricultural salt was not remunerative.

As in these two series of experiments the results obtained from the addition of a nitrogenous to a potassic manure were very irregular, it was considered advisable to carry out a third series of experiments with sulphate of ammonia added in varied proportions to chloride of potash. Still further, as the application of phosphates as superphosphate or basic slag resulted in a loss, it was also decided to test bone flour as part of a complete mixture.

This third series of experiments was started in 1909 at ten centres and repeated in 1910 and 1911 in eight and nine centres. The following dressings per statute acre were tested :

Plot 1. — Unmanured.
2. — ½ cwt. chloride of potash.
½ cwt. sulphate of ammonia.
3. — 1 cwt. chloride of potash.
¼ cwt sulphate of ammonia.
4. — 1 cwt. chloride of potash.
½ cwt. sulphate of ammonia.
5. — 1 cwt. chloride of potash.
— ¼ cwt. sulphate of ammonia.
— 2 cwt. steamed bone flour.
6. — 1 cwt. chloride of potash.

Whilst in 1911 the summer was extremely warm and dry, in 1912 it was abnormally wet and cold.

The average results per acre from the application of the different manures to the flax crop were as follows :

Number of plot	1	2	3	4	5	
Yield of retted flax . . .	3 229 lb.	3 614 lb.	3 593 lb.	3 739 lb.	3 294 lb.	3 285 lb.
" of scutched flax,	33 st. 12 lb.	38 st. 11 lb.	37 st. 5 lb.	39 st. 13 lb.	31 st. 2 lb.	35 st. 1 lb.
Returns from flax and tow	£14 8s. 8d.	£16 13s. 5d.	£16 3s. 0d.	£17 12s. 9d.	£12 19s. 9d.	£14 16s. 9d.
Cost of manure	—	12s. 6d.	13s. 6d.	17s. 6d.	£ 1 4s. 3d.	10s. 0d.
Estimated profit from use of manures	—	£ 1 12s. 3d.	£ 1 0s 7d.	£ 2 6s. 7d.	£ 2 13s. 2d. (loss)	1s 11d. (loss)

In valuing these results it must be borne in mind that contrary to usual experience the flax on the unmanured plots in 1912 showed no signs of yellowing, which caused the advantage derived from chloride of potash alone (Plot 6) to disappear.

Plots 2 and 3 showed a profit over Plot 6 in the years 1909, 1910 and 1912 and a loss in 1911; Plot 4 yielded a profit in 1910 and 1912 and a loss in 1909 and 1911 These different results cannot be attributed to the respective fertility of the various soils; it appears more probable that they are due to the climatic condition of the seasons. No definite recommendation can therefore yet be made as to the use of sulphate of ammonia with chloride of potash. Plot 5 showed that when given under the form of bone flour phosphates caused a loss: they favoured the growth of weeds and diminished the yield in scutched flax.

Liming experiments. — An experiment designed to test the value of liming was made on four plots, each one quarter of an acre in extent. After the application of the lime in 1911 all plots were cropped with oats and in 1912 with flax.

The treatment of the respective plots per acre was as follows:

Plot	1911 Oats	1912 lax
1.	no lime	no chloride of potash
2.	no lime	1 cwt do. do.
3.	1 ton burnt lime	no chloride of potash
4.	1 ton burnt lime	1 cwt. do. do.

The average results per acre are shown in the following table:

Number of plot	1	2	3	4
Yield of retted flax	2 724 lb.	3 142 lb.	2 896 lb.	3 343 lb.
Yield of scutched flax	37 st. 8 lb.	44 st.	42 st.	47 st. 8 lb.
Value of scutched flax	£16 3s. 2d.	£18 6s. 0d.	£18 6s. 9d.	£20 15s. 0d.
Cost of manure	—	10s.	5s.	15s.
Estimated profit	—	£ 1 3s. 3d.	£ 2 2s. 1d.	£ 3 17s. 0d.

Seed trials. — Each year since 1901 experiments have been conducted with seed imported by the Department of Agriculture for Ireland direct from Holland and Russia, in comparison with Dutch and Russian seed imported by Ulster merchants. The results are given in the following table:

	Russian seed imported by the Department	Belfast brand of Riga seed	Dutch seed imported by the Department	Belfast brand of Dutch seed	Irish seed 2nd. year of selection
Average 1901-1911, excluding 1903. Yield of scutched flax per acre	£14 15s. 6d.	£13 17s. 0d.	£14 11s. 5d.	£13 11s. 6d.	—
1912. Yield of scutched flax per acre	£14 8s. 7d.	£14 4s. 6d.	£15 1s. 0d.	£14 3s. 6d.	£8 18s. 8d.
1912. Yield of scutched flax per acre	35 st. 1 lb.	34 st.	38 st.	36 st. 1 lb.	22 st. 3 lb.

From these and preceding experiments the conclusions may be drawn that the variety of flax seed to be sown (whether Dutch or Riga) should not be governed by the class of soil for which it is intended but by the quality of the seed itself, which depends on the climatic conditions prevailing in the seed-producing countries. Thus in 1910 and 1911 Russian seed gave the better average results on the various classes of soil, while in 1909 and 1912 the Dutch seed proved the more productive. Farmers should, therefore, before purchasing seed, consult the leaflets of the Department which give information as to the harvest conditions during the previous year in Holland and Russia.

In comparative seed tests, "Pernan Crown" seed, another seed selected and grown on a farm in Russia for a number of years, Irish seed and Dutch Riga Child were tested. The first gave, on the whole, better returns than the second, and both better than the Dutch Riga Child. The crops from the selected Irish seed were much inferior.

Other tests were made with Irish seeds saved from the same crop, but at different stages of maturity. The perfectly ripe seed yielded 41 st. 10 lb. of scutched flax per acre, or 16.72 per cent. of the retted straw, the average returns of flax and tow per acre being £18 16s. 9d. The immature seed yielded 39 st. 10 lb. of scutched flax, or 16.60 per cent, and the total value of flax and tow was £15 19s. 7d. The higher return from the crop produced by the ripe seed is mainly due to the superior quality of the fibre.

In 1911 tests were commenced and will be continued on a large scale with a view to determining if it be possible to produce flax seed successfully in Ireland and to improve it for fibre production by selecting from long stalks. It has been observed that seeds detached from the stalks in the autumn and stored in granaries lost in germinative qualities, and that it is preferable not to ripple it until the following spring and to store the dried flax straw in small lots during the winter in lofts with open windows so that all the seed boll ends are exposed to a current of air. This straw was rippled in the latter end of February.

A definite conclusion cannot yet be drawn from these experiments. As the following table shows the selected Irish seed yielded less than the Pernan Crown, but a scutched flax of higher value.

	Selected Irish seed	Pernan Crown seed
Yield of dried retted straw per acre	25 cwt. 1 qr. 4lb.	26 cwt. 1 qr. 20 lb.
Yield of scutched flax per acre	33 st. 2 lb.	36 st. 0 lb
Percentage of scutched flax from retted straw	16.38	17.02
Value of scutched flax per cwt.	81*s.* 2*d.*	76 *s.*
Value of scutched flax per acre	£16 16*s.* 3*d.*	£17 2*s.* 0*d.*

1002 – **Contribution to the Study of the Lodging of Hemp.** — HAINSCH, HEINRICH, in *Mitteilungen der landwirtschaftlichen Lehrkanzeln der K. K. Hochschule für Bodenkultur in Wien*, Vol. II, Part 4, pp. 607-674. Vienna, August 8, 1914.

This study contains a detailed account of the cultural conditions of the experiment and the results of the examination of the hemp straw, the observations and measurements taken during growth, microscopic examination of the stems, determination of resistance to lodging and chemical analysis.

The possibility of lodging depends on the lower portion of the stem, and it is necessary to consider the histological conditions in this region in order to judge the resistance of the stem. Transverse sections at the base of lodged plants show a reduction of lignified fibres, and an increase of parenchyma. The pith is also generally more abundant in lodged stems and the lignified fibres are often arranged symmetrically, thus reducing the mechanical resistance along the line of symmetry. The histological differences between lodged and unlodged plants disappear in the upper parts of the stems.

The cells of the fibrous tissue of lodged plants are smaller, round and with a larger lumen. The fibres are smaller and less dense. As a result of lodging the growth of the cells is checked and they remain diminutive. The relative thickness of the cell-walls diminishes with lodging, but only in the lower portion of the stem. As a result of direct determinations of the resistance of the stems, it appears that the mechanical constants of the tissues are not influenced by the thickness of the cell-walls or of the stem.

Lodging considerably diminishes the mechanical resistance of the cells; the resistance of the stems to lateral forces is directly proportional to their weight, provided the thickness of the cell-wall is not abnormal. It has not been found that the degree of lignification has any influence on the power of resistance of the cells, though it is certainly greater on the lower portions of the stem.

Lodged plants show a higher percentage of ash. The percentage of silica diminishes from the base to the top of the stem and is greater in lodged plants, but as its total quantity is so small it cannot have any effect on the resistance to lodging; similarly also with regard to the percentage of calcium.

1003 – **Hemp Production in the United States.** — *Daily Consular and Trade Reports, Issued by the Bureau of Foreign and Domestic Commerce*, Year 17, No. 177. Washington, July, 30, 1914.

The falling off in the domestic production of hemp is due primarily to the increasing difficulty in securing sufficient labour to take care of the crop, to the lack of labour-saving machinery, to the increased profits in raising stock, tobacco and corn, and lastly to the rapidly increasing use of other fibres, especially of jute.

During the past three years interest in the hemp industry has been reawakened, and experiments are being tried with a view to the cultivation of the crop in new areas, such as large extents in the valley of the Mississippi and its tributaries, and in the Sacramento and San Joaquin Valleys in California.

Hemp cannot be economically grown in areas of less than 50 acres in any one locality, so as to warrant the use of machinery for harvesting and breaking.

The following is a general estimate of cost and returns for such an area of 50 acres:

Cost:	$
Ploughing (in fall) 50 acres, $ 2 per acre	100
Disking (in spring), 50 cents per acre	25
Harrowing, 30 cents per acre	15
Seed, 40 bushels, delivered, $ 4.50 per bushel	180
Seeding, 40 cents per acre	20
Rolling 30 cents per acre	15
Self-rake reaper for harvesting	75
Cutting with reaper, $ 1.50 per acre	50
Picking up from gavels and shocking, $ 1 per acre	50
Spreading for retting, $ 1.50 per acre	75
Picking up from retting swath and setting in shocks, $ 1.40 per acre	70
Breaking 50 000 lbs. fibre, including use of machine brake, 1 1/2 cents per lb.	750
Baling 125 bales (400 lbs. each), including use of baling press, $1.40 per bale	175
Marketing and miscellaneous expenses	150
Total cost	$ 1 750
Returns:	
Long fibre 37 500 lbs., 6 cents per lb.	2 250
Tow 12 500 lbs., 4 cents per lb.	500
Total returns	$ 2 750

1004 – **Cotton in Paraguay and Argentina.** — *Boletín del Departamento Nacional de Fomento*, Year 1914, No. 5, pp. 5-31. Asunción, May-June, 1914.

The results of an enquiry on the cultivation, marketing and trade in cotton made by the " Departamento Nacional de Fomento " of Paraguay are here presented.

Cotton in Paraguay. — Suitable cotton soils are plentiful in Paraguay and the crop was formerly grown in all districts. According to statistics for 1863 the yield was nearly 5 000 000 lbs. of ginned cotton.

All the best varieties except Caravonica have been tried in Paraguay, and it has been found that the tree cottons are more suitable to the climate

especially *Gossypium barbadense*, with *G. peruvianum* and *G. maritimum* which are really varieties of it. These like abundant rains, and Paraguay is more favoured in this respect than any other cotton-growing country. Good results have also been obtained at some places, in particular at the Agricultural Experiment Station of Puerto Bertoni, with varieties of *G. herbaceum*, especially Peterkin, Hawkins, and Allen. These varieties succeed in places where the others will not do, as in poor shallow soils. *G. barbadense rufum*, known in Paraguay as Mandipwita, is indigenous. It is used to a certain extent in the industry and sometimes makes a good price. If a steady market could be obtained for it, this species of cotton would be of great importance, since it yields well and is more resistant than other species.

Seeding is effected from June to the beginning of September; with late sowing the yield of the first crop is reduced, but the second is much greater. Sr. M. S. BERTONI made a successful experiment of sowing in January and February between rows of maize; if the maize is not sown too thickly the cotton grows well, though slender, and is protected from the cold. If cold weather prevails after the maize is harvested, the cotton is cut down to the ground, but if there is no likelihood of frost the young plants are left as they are. When the warm weather returns they grow rapidly and at the end of November the bolls begin to ripen.

Harvest begins in December, or January, or at the latest February, for the first year's crop and continues until the cold season or, if there is no fear of frosts, until June or July when the flowering period ceases and growth of the branches begins. In districts exposed to frost the plants are cut back in May, and the unopened bolls are collected and dried in sheds until they open: these pods yield the cleanest cotton.

Sr. Bertoni considers the yield per acre in Paraguay as the highest in the world, the average yield of the country being 534 lbs. per acre. At the experiment station at Puerto Bertoni he has obtained yields of 710 to 890 lbs. per acre of ginned cotton.

The following figures show the comparative yields of the different countries (in lbs. per acre):

	Minimum	Average	Maximum
Italy and Spain	68	135	225
Africa	90	180	360
United States	126	200	604
Argentine	180	305	630
Paraguay	360	540	923

In spite of natural conditions so favourable, the cultivation of cotton has not been seriously developed owing to a number of social factors.

Cotton in the Argentine Republic. — The following data have been obtained from the "Dirección General de Comercio e Industrias" of the "Departamento de Fomento" of the Argentine.

Almost all the Argentine cotton is produced in the region of Chaco, in loamy soils; the rainfall is 80 to 150 cm. (32 to 60 in.), fairly well distri-

buted. The common varieties grown are Texas Woods, Culpeper, Simkin, King, Russell, Peterkin, Allen, etc., all of American origin and of short staple. The " Departamento de Fomento " has begun a policy for the standardisation of the cotton of Chaco. The estimated area of cotton in 1914 is about 7000 acres ; it would have been much greater but for the depredations of locusts and prolonged drought. The average yield is about 1340 lbs. per acre of raw cotton, but of recent years it has been only 1080 lbs. per acre. Unginned cotton is bought by local merchants, who gin it and pack it for export. The seed is partly exported and partly used locally for oil extraction. Under normal conditions an acre of cotton yields a profit of £3 10s to £5 10s ; the initial expenditure, together with cost of seeding and picking, may be estimated at the same sum. Owing to scarcity of labour, the extension of this crop presents difficulties.

1005 – **The Indian Jute Industry.** — *The Agricultural Gazette of New South Wales*, Vol. XXV, Part 7, pp. 577-580. Sydney, July 1914.

The following data are taken from a report drawn up by J. B. SUTTOR, who was instructed by the Minister of Agriculture of New South Wales to visit the jute-producing districts of India.

India has practically a monopoly of the production of jute, the result being that the market fluctuates to a great extent and is subject to much speculation. The world's annual demand for raw jute is estimated by the Commercial Intelligence Department of India at about 1 700 000 tons ; 791 000 tons is the estimated mill consumption; the surplus is exported to the following countries :

England	340 000	tons
Germany	180 000	»
U. S. America	124 000	»
France	86 000	»
Other countries	179 000	»
Total	909 000	»

The jute manufactures represent 40 per cent. of the total value of exports of Indian manufactures, and the raw jute over 26 per cent. of Indian raw materials exported. During the financial year 1912-13 the exports of jute fabrics to the principal countries were as follows :

	Amount — £	Principal form of export —
U. S. America	5 840 333	Cloth
Argentine	1 944 687	»
Australia	1 433 733	Bags and bales
England	960 933	» » cloth
Chile	564 067	Bags
China	530 200	»

The above countries are followed in decreasing order by Canada, Java, Egypt, West Indian Islands, Straits Settlements, etc.

Bengal is the chief jute-producing centre of India. The area under jute is estimated at 3 400 000 acres and that an average crop yields about 1000 lbs. of jute fibre per acre, the quality of which is largely governed by soil and climatic conditions. The most satisfactory results are obtainable from rich loams provided with plenty of moisture. Jute is mostly grown in small holdings and solely worked by natives. The soil is frequently ploughed several times to pulverize it thoroughly before sowing, No special care appears to be bestowed on seed selection. The sowing takes place from February to April, broadcasting being generally adopted: about 8 lbs. of seed to the acre are used. While moisture is necessary, the jute areas are not irrigated except in cases where there is a falling off in rainfall or a great absence of humidity.

When the crop is about to flower, it is harvested. The stalks are then generally from 4 to 12 feet high or even more, according to climatic conditions. The harvesting takes place from June to August and sometimes up to September. The bundles of jute stems are submerged in water to ret for 10 or 15 days; then the fibre is removed from the core by hand with the help of very primitive implements, after which it is dried and bleached in the sun for two or three days.

The fibres are collected in small bundles and are then ready for sale. There are usually three middlemen between the grower and the mill or manufacturer. The bales for the local mills weigh 330 lbs. and those for exportation 400. The raw jute is classified as follows:

Nº. 1 quality, 80 to 90 per cent. suitable for Hessian warp and 10 to 20 per cent. of weft.

Nº. 2 quality, 60 to 70 per cent. of the former, and 30 to 40 per cent. of the latter.

Nº. 3,70 per cent. of sacking warp and 30 per cent. of weft.

Nº. 4,40 per cent. of weft.

For foreign markets the standard quality is usually quoted as of M group or "cracks", and means an equal proportion of Nº. 2 and Nº. 3 qualities.

Besides the above there are also lower grades called "cuttings" and "rejections".

In the mills the jute passes first of all through a softening machine with fluted rollers; it is then carded and spun. Thence it proceeds to the looms and when woven it passes through a callender with rollers heated up to 600° F., givng a smooth surface. In the case of cloth for wool bales, the fabric passes through another machine known as the "cropper", which removes any loose fibres from the surface of the cloth in order to avoid any jute fibre getting mixed with the wool.

STIMULANT, AROMATIC, NARCOTIC, AND MEDICINAL CROPS

1006 - **Composition of Essence of *Artemisia arborescens* and of *A. Absinthium* collected in Italy.** — 1. Jona, T., in *Annali di Chimica applicata*, Vol. II, No. 3 and 4, pp. 63-68. Rome, 1914. – 2. Paolini, V., and Lo Monaco, R., in *Atti della Reale Accademia dei Lincei, Rendiconti di scienze fisiche, matematiche e naturali* Vol. XXIII, Part 4, pp. 123-129. Rome, August 16, 1914.

1. — The essence of *Artemisia arborescens* was obtained by the distillation of the dried tops collected near Sassari (Sardinia), a little before flower-

ing. The yield was 0.57 per cent. of essence, with the following characters: deep blue colour, aromatic, slightly mobile, density at 15° 0.9458, soluble in 10 volumes of 80 per cent. alcohol and in all proportions of 90 per cent. alcohol, contains no nitrogen or sulphur, saponification value 29.3, acid value 9.8, etherification index 19.5. At normal pressures the essence distils between 90° and 210° C.

According to the researches of the writer it contains: *a*) 13.94 per cent. of alcohol of the formula $C_{10}H_{18}O$ (thuyol and a small quantity of another alcohol, probably borneol), 8.58 being free and 5.36 combined with fatty acids; *b*) formic, acetic, isovalerianic, pelargonic, palmitic and stearic acids, partly in combination with the above-mentioned alcohols; *c*) about 13 per cent. of β thuyone; *d*) a mixture of hydro-carbons of high boiling-point.

2. — Essence of *Artemisia Absinthium* obtained from fresh cultivated plants grown near Rome and Perugia, by distillation in a current of vapour gave the following analysis: *a*) about 10 per cent. of thuyone, consisting of the isomeric β dextro-rotary and the isomeric α thuyone; *b*) about 48 per cent. of thuylic alcohol, free and in combination with acetic, isovalerianic and palmitic acids; a mixture of at least two chemical compounds in which dextro-rotary δ thuylic alcohol predominates; *c*) phellandrene; *d*) cadinene; *e*) a blue oil of unknown composition.

1007 – **Two Crosses of Strong Tobacco in Italy.** — Aielli Donnarumma, in *Bollettino tecnico della coltivazione dei tabacchi*, Year XIII, No. 1, pp. 7-8. Scafati, January-February 1914.

With a view to improving the type of plant and the shape of the leaves of strong hybrids obtained by crossing "Italia" tobacco with Kentucky and Salento × Kentucky, crosses were made between the two hybrids themselves. The parental forms were immune from *Thielavia basicola* which causes so much damage to Kentucky tobacco. Four of the typical hybrids were selected, two of each kind, and reciprocal crosses were made. Thirty flowers were crossed and 30 seed capsules obtained. In the following year the two hybrids Italia-Kentucky × Salento-Kentucky and Salento-Kentucky × Italia Kentucky, were grown in land freely infested with disease and in which the Kentucky variety had failed during previous years. Although the season was not very favourable the two crops succeeded admirably. No plant showed the least attack of *Thielavia*, and the growth was so rapid that they considerably out-grew the rows of control plants in the centre of the plots.

The object of the cross was completely attained in the new hybrids, which combined the length of leaf of the Italia-Kentucky parent and the breadth of leaf of the Salento-Kentucky parent. The characters of the parents were so completely combined in the offspring that it required an experienced eye to distinguish between the reciprocal crosses. Cultural experiments will be made to ensure constancy of type.

1008 – **The Chemical Composition of the Tobacco Plant in its Various Stages of Growth** — Note I, on Xanthi Yaka grown in the Abruzzi. — *Communicated to the Institute by Professor* E. PANNAIN, *of the Royal University of Rome.*

With a view to contributing to the knowledge of the tobaccos grown in Italy and of resolving certain problems of biological and technological chemistry, it was considered advisable to determine the variation in chemical composition of the plant during its growth and the effects produced by the different treatments of drying and fermenting to which the green leaves are subjected during the process of manufacture. These results were obtained in researches on the variety Xanthi Yaka, grown at Francavilla al Mare (Abruzzi). Analyses were made of seedlings in the nursery, plants before flowering, ripe leaves from each picking and the bare stems and roots remaining in the field after harvest.

In this preliminary study the following determinations were made of different parts of the plant after drying in a water oven : ash, total nitrogen, nicotine, organic acids, ether extract, alcoholic extract. Ordinary methods were used except in the case of nicotine, for which a slight modification of Keller's process was preferred on account of its rapidity : the nicotine was displaced by 20 per cent. potash and extracted by a mixture of equal parts of sulphuric and petroleum ether, then titrated against $\frac{N}{10}$ sulphuric

TABLE I. — *Analyses of seedlings.*

Parts analysed	Ash	Total nitrogen	Nicotine	Organic acids	Ether extract	Alcohol extract
Leaves	15.92	4.45	1.13	5.03	9.03	21.84
Stem	18.40	2.90	0.48	5.40	8.20	21.40
Roots	14.33	3.04	0.80	3.93	4.00	12.00
Whole plant	15.85	3.81	0.65	4.45	7.30	18.10

TABLE II — *Analyses of plants before flowering.*

Parts analysed		Ash	Total nitrogen	Nicotine	Organic acids	Ether extract	Alcohol extract
Leaves from middle and lower portion of plant.	whole	10.50	2.86	1.18	3.56	8.01	23.80
	blade	10.40	2.92	1.23	3.47	8.30	24.90
	ribs	10.60	2.02	0.80	4.01	5.06	16.21
Apical leaves	complete	11.10	4.30	0.89	3.36	9.21	24.50
	blade	12.45	4.70	0.91	3.45	9.45	25.50
	ribs	10.55	2.08	0.81	4.01	5.00	16.15
Stems		6.40	1.25	0.29	3.65	2.40	21.10
Roots		6.85	1.69	0.65	4.23	1.85	18.60

acid with congo red as indicator. The organic acids were displaced by sulphuric acid 1 : 3, extracted with ether, titrated against soda using phenolphthalein as indicator, and expressed as oxalic acid.

The seedlings were analysed as a whole as well as in portions, and gave results as shown in Table I.

The analyses of the plant before flowering are given in Table II.

The leaves harvested at the 1st (basal), 2nd, 3rd and 4th (apical) periods were analysed whole and in parts (blades and ribs). The bare stems and roots remaining in the field were also analysed. The results are set out in Table III.

TABLE III — *Analyses of leaves of the various pickings.*

		Ash	Total nitrogen	Nicotine	Organic acids	Ether extract	Alcohol extract
1st picking	whole leaves	16.10	1.57	1.42	4.61	9.95	32.15
	blades	16.40	1.69	1.56	4.50	10.15	32.75
	ribs	14.70	1.23	0.46	4.64	4.90	24.95
2nd picking	whole leaves	12.30	1.00	1.52	4.52	10.00	34.15
	blades	12.35	1.02	1.94	4.50	10.40	40.55
	ribs	12.10	0.77	0.73	4.54	4.90	27.35
3rd picking	whole leaves	8.55	1.26	0.75	3.75	9.65	45.10
	blades	8.25	1.35	0.84	3.52	10.40	46.05
	ribs	9.80	0.96	0.24	3.91	3.15	33.60
4th picking	whole leaves	7.50	1.50	0.74	4.07	10.80	43.25
	blades	7.20	1.58	0.81	3.76		
	ribs	9.00	1.34	0.32	4.95		
Bare stems		6.40	0.55	0.19	3.92	1.80	10.20
Roots		7.40	0.72	0.16	7.78	1.25	8.60

These results show that :

1. Seedlings are richer in ash, nitrogen and organic acids than half-grown or full-grown plants.

2. In plants before flowering, the apical leaves are richer in ash, nitrogen, and substances soluble in ether and alcohol than the lower leaves, but they contain less nicotine and organic acids.

3. In ripe leaves, the ash content decreases from the basal (1st picking) to the apical leaves (4th picking), and the leaves of the 1st and 2nd pickings are also richer in nicotine, containing double the quantity of the leaves of the 3rd and 4th pickings.

4. The leaf blades are always richer in nitrogen, nicotine and substances soluble in alcohol and ether than the ribs, and generally also in ash, but they are poorer in organic acids.

5. The stems and roots contain less ash, nitrogen, substances soluble in ether and alcohol, and nicotine than other parts of the plant, but the roots contain more nicotine than the stems.

1009 – **The Cultivation and Collection of Medicinal Plants in England.** — WHATMOUGH W. A., in *The Journal of the Board of Agriculture*, Vol. XXI No. 6, pp, 492-510 + 13 figs. London, September 1914.

The cultivation of medicinal herbs in England began in very ancient times and gained gradually in importance with the decrease of uncultivated lands and of wild plants. During recent years the acreage devoted to drug cultivation has been more and more restricted by competition with wild foreign products; nevertheless English drugs and essences have still a reputation which allows of their being sold at about four times the price of the Continental article.

The limited outlet for most drugs makes overloading the market a comparatively easy matter; prices then become excessively low for the producer, with the result of restricted production, which in its turn leads again to high prices. As an illustration the writer instances Belladonna; in 1900 the supply of home grown Belladonna was in excess of the amount required for making green extract, and the price of the surplus leaves, after drying, was gradually reduced until being sold in competition with the wild foreign supplies they were disposed of at a loss. The result was that cultivation was practically limited to four drug farms having factories for making Belladonna preparations. But in 1912-13 there was an interruption in the continuity of Belladonna leaf and root exports from Croatia and Slavonia in South Hungary, the chief centres for foreign Belladonna; prices rose to such an extent that roots which realized 45*s* per cwt. in January sold for 150*s* before the end of August. Belladonna leaves from abroad, which sell at normal times for 45*s* to 50*s* per cwt., are now unobtainable at 1*s* per lb. In order to avoid as much as possible such fluctuations, the writer suggests adopting cooperation between growers and wholesale druggists.

The south of England is especially suited to drug growing and is further favoured by being close to the principal consuming market.

The writer then reviews the most important medicinal plants grown in England, namely:

Aconite (*Aconitum Napellus* L.). — The roots are mostly used, the leaves being of little importance. The chief collecting centres for the foreign root are the Swiss Alps, Salzburg, North Tyrol and Vorarlberg; Spain supplies some also and Japanese root (usually ascribed to *A. Fischeri* Reichb.) is plentiful.

Anise (*Rimpinella Anisum* L.). — It is cultivated at Westington near Chipping Norton, but the English climate is hardly warm enough to ripen the fruit properly and does not warrant further attempts at cultivation, even if market conditions, should be favourable.

Belladonna (*Atropa Belladonna*, L.). — The plant grows wild in the southern counties of England. When cultivated it yields an average crop of fresh herb in the second and third years of 5 to 6 tons to the acre. A second

crop is obtained in September in good seasons. It is sometimes attacked by a small beetle, *Epitrix atropae*. Paraffin and soap emulsion is stated to kill this.

Caraway (*Carum Carvi*, L.). — Caraway is largely grown in the Netherlands. In England it is mostly cultivated in Essex and Kent; it appears naturalized in some parts of Lincolnshire.

Chamomile (*Anthemis nobilis* L.). — Belgium is the chief grower of this plant. English chamomile is normally practically all used for distillation of oil. The yield of dry flowers is about 4 cwt. per acre. From 5 to 6 lbs. of fresh flowers yield 1 lb. of dry flowers.

Coriander (*Coriandrum sativum*). — Coriander is grown in Lincolnshire and East Anglia, often in conjunction with caraway. It yields about 15 cwt. per acre. English-grown coriander has the reputation of possessing the finest flavour.

Dandelion (*Taraxacum officinale* L.). — Ordinarily English roots are sold in competition with German roots. The yield is about 4 or 5 tons of fresh roots to the acre in the second year. A hundred parts of fresh root yield twenty-two of dry material.

Foxglove (*Digitalis purpurea* L.). — The Continental supplies come chiefly from Thuringia and the Harz mountains. It grows wild in England, and is also cultivated by a few growers ; the yield is about 1 to 2 tons of fresh leaves per acre.

Dill (*Peucedanum graveolens* B. & H.). — It is grown chiefly in East Anglia, and produces from 5 to 7 cwt. of dill fruits per acre.

Fennel (*Foeniculum capillaceum* Gilibert). — The best fennel is supplied by France, Saxony and Russia. Fennel is largely used for cattle condiments. When grown in England it becomes an annual, and it would probably yield a crop of 15 cwt. per acre.

Golden Seal (*Hydrastis canadensis* L.). — Golden seal is an American drug. It was formerly so abundant in Ohio as to be considered a pestilent weed, but the drug collector and the improvement of land denuded the natural growing areas (deep shady nooks in forests with rich deep moist soil and now the supply is so limited that the price has quadrupled since 1905. In England it appears to be grown only in one locality — at the Wellcome Materia Medica Farm, near Darenth, Kent. It has also been successfully grown near Moscow in the shade of apple trees. In 1912 the United States Department of Agriculture reported that the cultivation of golden seal was "successfully established". After initial experiments commenced in 1899 by the above Department, 5120 lbs. of fresh roots per acre, corresponding to 1500 lbs. of marketable roots, were obtained.

Henbane (*Hyosciamus niger* L.). — This biennial is cultivated in England for the preparation of the extract; the dry commercial leaves imported from Germany and Russia are derived from the wild annual. The fresh leaves lose 80 per cent. of their weight on drying.

Egyptian Henbane (*Datura Metel* L.). — It thrives very well at the Wellcome Materia Medica Farm in Kent.

Opium Poppy (*Papaver somniferum* L.). — Though the crop is a precarious one, the white variety of opium poppy is still grown in several parts of England, notably Lincolnshire. Belgium ordinarily supplies a proportion of the poppy heads used in the United Kingdom.

Thorn Apple (*Datura Stramonium* L.). — It is not grown on a commercial scale in England ; considerable amounts of the wild leaves are imported from Germany and Hungary. The demand for seed is very limited. About 34 parts of dry leaves are produced from 100 parts of fresh ones.

Datura Tatula is occasionally used in medicine in place of *D. Stramonium.*

Valerian (*Valeriana officinalis* L.). — Valerian is common in England in moist situations. Most of the rhizomes of commerce are grown in Derbyshire or imported from Holland, Germany and France. About 24 parts of the dry product are obtained from 100 of fresh rhizomes.

Other Medicinal Plants.

Experimental growing of some American drugs such as senega, grindelia, pokeroot and lobelia is made at Darenth.

Medicinal herbs for sale are cultivated at Carshalton. The following are regularly grown :

Balm (*Melissa officinalis* L.).
Comfrey (*Symphytum officinale* L.).
Feverfew (*Chrysanthemum Parthenium* L.).
Greater Celandine (*Chelidonium majus* L.).
Germander (*Teucrium Scorodonia* L.).
Marsh Mallow (*Althaea officinalis* L.).
Mugwort (*Artemisia vulgaris* L.).
Pennyroyal (*Mentha Pulegium* L.).
Rue (*Ruta graveolens* L.).
Southernwood (*Artemisia abrotaneum*).
Tansy (*Tanacetum vulgare* L.).
Wormwood (*Artemisia Absinthium* L.).
Yarrow (*Achillea Millefolium* L.).

Among the medicinal plants which grow wild in England and which are, or might be, collected the writer mentions the following :

Barberry (*Berberis vulgaris* L.).
Bittersweet (*Solanum Dulcamara* L.).
Broom (*Cytisus scoparius* L.).
Buckbean (*Menyanthes trifoliata* L.).
Burdock (*Arctium Lappa* L.).
Centaury (*Erythraea Centaurium* Pers.).
Coltsfoot (*Tussilago Farfara* L.).
Elder (*Sambucus nigra* L.).
Figwort (*Scrophularia nodosa* L.).
Hemlock (*Conium maculatum* L.).
Horehound (*Marrubium vulgare* L.).

Male Fern (*Aspidium Filix-Mas* Sw.), a very common fern in moist sheltered stations ; hitherto Germany (Harz and Thuringia) supplied all the male fern rhizome or extract used in England.

Meadow Saffron (*Colchicum autumnale* L.).

Meadowsweet (*Spiraea Ulmaria* L.).

Mullein (*Verbascum Thapsus* L.).

Red Poppy (*Papaver Rhoeas* L.), the petals of which find a steady, if limited market.

Sweet Flag (*Acorus Calamus* L.).

Yarrow (*Achillea Millefolium* L.), etc.

Other medicinal herbs, such as squirting cucumber and *Lactuca virosa*, are cultivated in a small way.

A bibliography of 20 works is given as an appendix to the paper.

1010 – **New Garden Plants of the Year 1913.** — *Royal Botanic Gardens, Kew, Bulletin of Miscellaneous Information*, Appendix III. – 1914. 86 pp. London, 1914. MARKET GARDENING

The number of garden plants described yearly is so considerable that it has been thought desirable to publish a complete list of them in the Kew Bulletins each year. The present list comprises all the new introductions recorded during 1913. It includes not only plants brought into cultivation for the first time during 1913, but also the most noteworthy of those which have been re-introduced after being lost from cultivation, and new hybrids. The list contains 454 plants. Of each species or variety the description is given and the publication from which the description is drawn.

1011 – **Pruning Hardy Shrubs.** — BECKETT, E., in *The Journal of the Royal Horticultural Society*, Vol. XL, Part I, pp. 24-34 + 8 figs. London, August 1914.

The growing of ornamental shrubs has developed greatly in the United Kingdom during the last 20 years and a great number of new species have been introduced from the Far East ; most of them prove hardy and adapt themselves well to their new home.

The question of the most suitable pruning is very important in order to ensure their maximum ornamental effect. The writer bases the following advice on his own long experience :

Shrubs that require but little pruning, except to keep them in a shapely condition, are: *Arbutus Unedo*, which however, if it has been allowed to grow straggling, can be safely cut back to within 2 or 3 feet of the ground ; *Aristotelia Macqui ; Garrya elliptica ; Escallonia* spp. ; *Cassinia fulvida* (*Diplopappus chrysophyllis*) which much resents being cut into the hard wood ; *Cotoneaster* spp., especially the new varieties introduced from China, while some of the older and more common varieties, for example *Simonsii* and *microphylla*, may be cut to within a few inches of the ground if necessary ; *Cytisus* spp., which sufffer much when cut back into old, hard wood ; *Hymenanthera crassifolia*, to be pruned in spring ; *Baccharis patagonica* and *B. halimifolia ;* most varieties of *Ilex* require to be pruned in July ; many of the newer forms of *Viburnum* (while *V. Tinus* answers well when severely cut into the old wood) ; *Calycanthus floridus, C. glaucus* and *Chimonanthus*

fragrans should always be pruned immediately after flowering ; *Hamamelis*, which require very little pruning and that when necessary should be done after flowering ; *Paeonia Moutan*, the chief pruning they require is to prevent the stocks on which they are generally grafted getting the better of the variety ; *Abelias*, *Myrica Gale* (in early spring) ; *Exochorda* (directly after flowering) ; *Diervilla* or *Weigelas* (as soon as flowering is over) ; *Cydonia japonica genista ; Clerodendron tricholomum ; Coronilla Emerus ; Hippophae rhamnoides ; Hydrangea ; Rhodotypus kerrioides ; Potentillas ; Rhammus ; Spiraea discolor, S. arguta, S. bracteata, S. media, S. Henryi, S. Thunbergii*, and *S. Wilsonii* ; the various species of *Syringa*, which succeed better on their own roots than grafted on *S. vulgaris ;* they should be pruned immediately after flowering ; Ericas ; Azaleas ; Rhododendrons, Junipers, etc.

The following require light pruning while they are young, answer well to the knife when adult and when they are old may be cut down to the ground : *Aucuba japonica* and its varieties, the different kinds of *Phillyrea*, etc.

Other plants that answer well to pruning, even if it be severe are : the various species of *Berberis*, some of which, *B. japonica* for instance, may be cut down to the ground when on growing old they become unsightly ; it is a mistake to graft the newer choice species from China on *B. vulgaris ;* as the greatest possible care is needed to prevent the stock outgrowing the variety ; the arborescent forms of *Hedera Helix ; Ulex europaea, Corylopsis ; Hypericum* spp. which usually require only light pruning ; *Philadelphus ; Ceanothus ; Stephanandra Tanakae* and *S. flexuosa ; Thuja gigantea ; Taxus baccata*, etc.

The following require severe pruning : *Bupleurum fruticosum* (every year in March) the bushy *Loniceras*, which must be pruned after flowering ; most of the species of *Ligustrum ; Budleia* (second week in April) ; *Caryopteris Mastracanthus ; Leycesteria formosa ; Amorpha canescens, A. fruticosa ; Forsythia* (after flowering) ; the various species of *Cornus*, especially *C. alba*, which should be cut down to the ground every year in the first week of April ; *Sambucus ; Spiraea japonica, S. Douglasii, S. hypericifolia, S. salicifolia, S. chamaedrifolia* (during the winter months), *S. arborea, S. Lindleyana, S. sorbifolia* and *S. Aitchsoni* (require pretty severe pruning about the last week of March) ; *Rhus* (never before the first week of April) ; *Salix*, (in the first week of March) ; *Symphoricarpos racemosus* (which has to be cut down to the ground every year) ; *S. orbiculatus* about every seven years ; *Tamarix*, which should be cut to within two or three inches of the base of the previous year's growth ; the majority of the climbers, such as *Lonicera, Polygonum, Vitis* and *Wistaria*.

FRUIT GROWING

1012 — **Vine Growing and Wine Making in Rumania.** — Pisoschi, Elia, in *Le Mouvement Economique*, Vol. XX, No 116, pp. 73-88. Bucarest, July 1914.

Rumania is on the northern limit for the cultivation of the vine. Since the vine is more affected by cold damp summers than by severe winters, the dry warm summers of Rumania enable this crop to be grown successfully in spite of the rigorous winter.

The best lands for vine growing in this country are those situated at an altitude of 150 to 400 m. (500 to 1300 ft.). The nature of the soil enables vines to be planted in all districts within the above altitudes with the exception perhaps of the extreme northern districts of Botoshani and Dorohoi.

The area of land under vines in 1882 was 287 075 acres, but owing to the ravages of phylloxera it had decreased to 222 467 acres in 1913. The reconstitution of the destroyed vineyards with American stocks was begun in 1893. This work progresses slowly but surely, the area under American stocks having increased from 338 acres in 1893 to 25 403 acres in 1913.

According to the statistics of the Ministry of Lands, the distribution of the vineyards in 1913 was as follows :

		acres
In bearing	Native	112 195
	American	67 173
Reconstituted but not yet in bearing	Native	13 062
	American	30 037
	Total	222 467

Although the area occupied by vines only represents 0.69 per cent. of the total area of the country, the vine is of the greatest economic importance to Rumania, for with an average yield of 175 gallons per acre and an average price of 1*s* 4*d* per gallon, the gross returns are about £. 12 per acre, apart from the value of the residues.

The statistics of the number of vine-growers, grouped according to the area of their vineyards, show that 95 per cent. of them do not possess more than 1 hectare (2 ½ acres) of vines. The largest extents of vineyards are found in the following districts :

	acres
Putna	34 601
R. Sarat	21 155
Prahova	13 747
Valcea	13 720
Buzèu	12 894
Dolj	10 787
Tecuci	10 218

From the point of view of quality, the vineyards of Cotnari give white wines very much appreciated, but this region is to-day entirely infested by phylloxera and in course of replanting.

On account of the rigorous climate the vines are covered with soil during the winter, after the pruning, except when this is postponed till spring owing to cold weather setting in early ; in this case the vines are simply tipped before burial. They are unearthed during the last weeks of March and begin to shoot early in April in the south, a fortnight later in the north.

The varieties planted are either old native sorts grafted on American stocks, or foreign vines. The choice of varieties has not always been made

prudently or competently. The most important native varieties are as follows:

White: Grasa (Cotnari region), Feteasca Galbena (Odobeshti), Cramposhia (Dragashani), Gardanul (Dragashani), Gordinul (Dealul Mare).

Red: Babeasca (Nicoreshti), Brgahina (Dragashani), Roshu Vartos and Roshu Moale (throughout the country).

The most common foreign varieties are:

French: Cabernet, Malbec, Sauvignon, Cinsaut, Clairette, Pinot, Aligoté, Gamay, Aramon, Carignan, Muscat, Alicante, Bouschet, Colombaud.

German: Riesling.

Austro-Huangarian: Sylvaner, Veltliner, Kadárka.

Wine making is still in a primitive state, owing to the number of small growers who cannot afford the expense of modern apparatus. In 1913 Rumania produced, from the 179 368 acres of vines in bearing, 33 515 430 gallons of wine, valued at £2 188 250. According to the statistics of the Ministry of Industry and Commerce, the movement of wines in 1911 was:

		gallons	£	s
Imports	In bottle	14 831	4 547	18
	Otherwise	132 131	28 599	16
	Total	146 962	£33 147	14
Exports	In bottle	625	191	14
	Otherwise	3 620	197	16
	Total	4 245	£389	10

Experiments on the production of sparkling wines are very numerous at the present time, but the future of such wines is still doubtful.

FORESTRY

1013 – **The Resin Pine of Tonking.** — CARRIÈRE (Inspector of Waters and Forests) in *Gouvernement général de l'Indochine, Bulletin économique de l'Indochine*, Year 17, No 108, pp. 329-335 + 3 figs. Hanoï-Haiphong, May-June 1914.

Pinus Massoniana, which yields more resin with a higher strength of essence than *P. maritima*, abounds in Indo-China, especially in the region of Quang-Yên. Pines also occur in Tran-Ninh, Lang-Bian, in the mountains of Ha-Giang and in Cambodia, especially in the first two regions; but they are not the same species as those in Quang-Yêen and may be considered as allied to *P. montana*.

In order to realise the value of this natural wealth, the Forest Department of Tonking has taken over the control of the cutting and instructed the natives in the methods employed with *P. maritima* in the Landes. At the present time some 70 000 pines are being cut in Quang-Yên, and this number may be increased by at least 5000 trees a year for at least 20 years.

The natural regeneration of the *P. Massoniana* forests is rapid and vigorous, and the Forestry Department has undertaken the reafforestation of certain cleared areas. Under average conditions the percentage of trees obtained by sowing in pots is about 20. One tree will yield about

lbs. of resin, containing 17 to 22 per cent. of essence. The resin is valued at about 7*s* 6*d* per 100 lbs.

There are numerous unproductive areas in the delta region of Tonking that would yield good returns if planted with resin pines. *P. Massoniana* (the variety with needles in pairs) flourishes in Yên-Thê and the province of Thai-Nguyên.

1014 – **The Balsam Fir.** — ZON, R., in *U. S. Department of Agriculture, Bulletin* 55, pp. 68 + 8 figs. + 2 tables. Washington, D. C., 1914.

This monograph on the Balsam fir (*Abies balsamea* Mill.) deals with its distribution, the forest types in which it occurs, its yield of timber, economic importance specially from the point of view of the pulp industry, methods and cost of working, biology, characters of the timber, rate of growth and proposed methods of cultivation.

The total volume of timber in the zone of commercial exploitation is estimated at about 5 billions of board feet, or sufficient to last 30 years at the present rate of consumption.

With the present methods of cutting, the balsam fir gradually predominates over the American red fir (*Picea rubens* Sargent) in mixed plantations (1).

The growth of the balsam fir is more rapid than that of the red fir, but its life cycle is shorter and it reaches maturity earlier. It should be cut at 100 to 125 years, whilst the red fir under natural forest conditions requires 175 to 200 years. The annual growth of the balsam fir varies from 21 to 42 cubic ft. per acre.

The cultivation in small groups is recommended as the best method of management for this fir, and ensures a better proportion of the red fir during the natural regeneration of the forest.

The chief objections to the utilization of the balsam fir in the production of pulp are as follows: 1) the resin present in the wood; 2) the shortness and weakness of the fibre; 3) the inferior yield of cellulose. The first drawback depends more on the manner of treating the wood than on its contents, the balsam fir being one of the rare conifers with a complete absence of resin canals.

1015 – **The Manchurian Timber Industry.** — BISHOP, C. M., in *Daily Consular and Trade Reports*, Year 17, No. 173, pp. 504-506. Washington, July 25, 1914.

The principal forests of North Manchuria are located in the upper valleys of the Sungari, Tumen, Yalu and Ussuri Rivers and the beginning of the Long White Mountain ranges.

Chinese official statistics are so far available for only one of the " Three Eastern Provinces ", *i. e.* Kirin. In this province alone it is estimated that 7 500 000 trees were cut in 3 years (1910-1912), this figure including pine,

(1) The distribution of the Balsam fir extends from Newfoundland to Great Bear Lake in the West and southwards to the uplands of Virginia; the distribution of the red fir is analogous but less determined (Cf. RATTINGER, K. K.: Die Nutzhölzer der Vereinigten Staaten. I. Teil: Die Nadelhölzer, *passim*. Wiesbaden, 1910). (*Ed.*).

cypress, walnut, chestnut, willow and oak. Chinese statistics give a total area of 2 111 square miles of timberland in Kirin Province.

There are two varieties of oak cut in Manchuria, — Mongolian oak (*Quercus mongolica*) and Chinese oak (*Quercus castaneifolia* or *sinensis*). The Mongolian oak is met with all over the regions drained by the Amur, Sungari and Ussuri Rivers, and everywhere in South Manchuria, where it reaches a height of 70 feet and a diameter of 2 to 4 feet. The Chinese oak occurs only in North Manchuria and is smaller than the Mongolian with leaves resembling those of the chestnut.

The granting of timber concessions in North Manchuria is governed by the " Regulations of 20 rules, governing the granting of concessions in national forests in the three Eastern Provinces (Manchuria) ", enforced by order No. 21, of the first year of the Republic of China (1912), issued by the Department of Agriculture and Forestry. Concessions are granted only to those possessing citizenship in the Republic ; and when a concessionaire desires to transfer or mortgage his certificate to another person, he must first obtain the sanction of the Bureau of Forestry.

Lumber taxes are of two classes : *a*) Royalty of national forests at the rate of 8 % according to market value, to be used in defraying the expenses in the administration of national forests, and *b*) Government tax at the rate of 10 % of the market value, and collected by the Department of Finance for the administrative expenses of the Government ; *c*) a local tax may be imposed depending on the size and quality of the timber.

The Russian timber concessionaries, who formerly supplied only the needs of the Chinese Eastern Railway, have begun to receive orders from Europe and England for timber. There were exported to European ports in 1913 via Vladivostock 200 000 cubic feet in round and square logs and boards. It is probable that in the future this timber will be shipped in increasing quantities from Nikolaievsk ; but it is doubtful if this export of timber will continue, for as soon as the present plans for the construction of the new railways in Manchuria are put into operation, there will be a greatly increased local demand for timber. Also there is an increased demand for Manchurian timber in China and the Far East generally, since it is valued more highly than Japanese or Korean timber.

According to Chinese customs statistics, about 9 000 000 cubic feet of timber material were exported to Vladivostok and over 3 000 000 in pieces during 1909. An increase in the duty reduced the export to 1 570 000 cubic feet in material and 147 000 in pieces in 1911. Further, a considerable amount of timber in the form of firewood, sleepers, round logs and boards are required in the construction of the Chinese Eastern Railway.

LIVE STOCK AND BREEDING.

HYGIENE

1016 - ***Eleusine indica* (Crowfoot Grass) in Queensland, Dangerous to Stock.** — Smith, Frank, and White, C. T., in *Queensland Agricultural Journal*, Vol. II, Part 2, pp. 158-160 + 1 fig. Brisbane, August 1914.

Eleusine indica had already been reported as a plant dangerous to live-stock in New South Wales. The writers have observed its occurrence in

Queensland, where it grows throughout the State, though mostly in coastal localities. They ascertained the presence in it of compounds containing hydrocyanic acid. The freshly cut grass (in June of the present year) yielded by maceration with water and distillation 0.92 grain of hydrocyanic acid per pound. The quantity would probably have been still larger if the plant had been cut when in vigorous growth, that is during the summer months. Cases of sickness in horses and sudden mortality of poultry in Queensland runs infested with *Eleusine* are attributable to this plant.

1017 – **The Sheep Maggot Fly (*Calliphora rufifacies*) and its Parasite.** — FROGGATT, WALTER W. (Government Entomologist), in *The Agricultural Gazette of New South Wales*, Vol. XXV, Part 2, pp. 107-111 + 1 plate. Sydney, February 1914.

In the first records of flies that deposit their eggs on sheep in Australia, the Sheep Maggot Fly was not included among those that bred in the soiled wool of living sheep. Nor was it included among sheep flies in a paper by the author published in 1905. In 1910 he had not yet bred it from the maggots found in soiled wool of New South Wales, though in the West it was very plentiful about killing yards, freshly skinned sheep and dead animals.

After 1910 it was soon found that the so-called "hairy maggots" were the larvae of this fly and that it also bred in soiled wool. But at that date *Calliphora rufifacies* was not as common as *C. oceaniae* and *C. villosa*, which till then had been the most injurious. This is another case of the adoption of new habits by a previously harmless insect on account of new conditions arising through the presence of strong smelling wool. From the writer's investigations in the northern and western districts of New South Wales and Western Queensland it is evident that this is now the common sheep fly, while the other two species, from which it probably first acquired the habit, have almost disappeared from this great area and do comparatively very little damage.

Lucilia sericata, the sheep maggot fly of Great Britain, lays its eggs on meat and has been a pest chiefly in Ireland and Scotland from a very early date. It is a common meat blowing pest about Sydney and suburbs, but in earlier investigations it had never been noted in the West or North-West, though now well established, and it has been bred from soiled wool. Hitherto it had never been recorded from the wool or wounds on sheep.

In September 1913 the Minister of Agriculture of New South Wales instituted an Experiment Station for the study of Sheep Maggot Flies near Yarrawin, district of Brewarrina, where sheep maggot flies have been a very serious pest for some years. This Station has discovered that an indigenous chalcid parasitizes very actively the larvae of *Calliphora rufifacies*, as well as those of *C. villosa* and *C. oceaniae*, and that it multiplies very rapidly when bred under artificial conditions. It takes about eleven days to develop from the egg to the perfect insect, which is a small wasp one-twelfth of an inch in length.

1018 – **Typhus in Young Pigs in Germany.** — PFEILER and HURLER, in *Mitteilungen des Kaiser Wilhems Instituts für Landwirtschaft in Bromberg*. Vol. 6, Part 4, pp. 261-283. Berlin, March 1914.

This paper contains many bacteriological, pathological and anatomical data on the typhus of young pigs and on its diffusion in the German Empire.

So far as it has been studied by the writers in many localities, it is easy to recognize by anatomical examination.

The disease is undoubtedly very widely spread and it has been found by the writers once or more in the provinces of Brandenburg, Hanover, East Prussia, West Prussia, Pomerania, Posen, the Grandduchy of Mecklemburg and in Alsace and Lorraine. Altogether in the course of two years the dangerous disease was observed by them in upwards of a hundred young pigs in twenty-two herds. The writers are convinced that if other countries also were to pay more attention than they have hitherto given to this disease it would be found to be no less frequent abroad than in Germany.

From the point of view of its epidemic character the disease should be considered as important as swine fever. Economically also, owing to the great mortality which it causes, it should command the greatest attention. Of the cases observed by the writers 78 per cent were fatal. According to the information given by the owners in whose herds the disease was rife, it caused a loss of from 25 to 50 per cent. According to other informants the mortality was valued at 60 per cent. Anyhow, where the disease appears pig breeding and its profits are seriously endangered.

In order to check the spread of the disease, veterinary police regulations would be useful; practically it can be successfully controlled by the vaccination of all young pigs.

1019 – **Control of Cattle Ticks and of the Diseases Spread by them** (1). — BRÜNNICH, J. C. and SMITH, F. Factors Influencing Efficacy and Deterioration of Cattle-dipping Fluids, in *Queensland Agricultural Journal*, Vol. II, Part I, pp. 81-92. Brisbane, July 1914. — II. THEILER, A., Arsenic Dips and their Use in the Control of Ticks and of the Diseases Spread by them in South Africa, in *Zeitschrift für Infektionskrankheiten, parasitäre Krankheiten und Hygiene der Haustiere*, Vol. 16, Part 1-2, pp. 1-26. Berlin, September 12, 1914.

I. — A series of experiments was undertaken to investigate the mode of action in the extermination of cattle ticks by means of dipping fluids. Two steers were sprayed with an arsenic dipping fluid (Queensland Government formula) to avoid accidental swallowing. Blood drawn before and after the spraying showed that the effect of the dip on the animal was to increase the arsenic content of the blood during the twenty-four hours immediately following the application of the dip. Two infected heifers were then treated, on small areas of the skin, as follows.

A) Ticks were painted carefully with dipping fluid without wetting the skin of the host.

(1) See also: *B.* 1911, Nos. 2198, 2425, 2753; *B.* 1912, Nos. 146, 358, 359, 810, 934; *B.* 1913, Nos. 42, 43, 691, 815, 1264. (*Ed.*).

B) The skin of the host was wetted without wetting the ticks.

C) Small quantities of the dip (5 cc.) were injected subcutaneously.

D) Larger areas of skin with ticks were thoroughly wetted with dipping fluid.

Only D proved an effective method of destroying ticks, though some of the ticks in trials A and C appeared to sicken. These experiments, together with the fact that the ticks on small areas which escape wetting in ordinary dipping operations (such as the head) do not die, led the writers to conclude that when an arsenic dip of minimum concentration is used, the death of the ticks within a few days is due to the combined effect of *a*) absorption of the poison through the skin of the tick after dipping, and *b*) absorption of the poison by the skin of the animal from which it is subsequently sucked by the tick.

The efficacy of any dipping fluid depends largely on its power of thoroughly wetting the skin of host and tick, leaving a uniform thin film of liquid, *i. e.* on its degree of emulsification. In order to determine the emulsifying power of certain agents, a series of experiments was carried out in which the surface tension of solutions of different recognised or supposed emulsifiants was determined by observing the number of drops formed when a measured quantity of liquid was allowed to run through a fine opening. The result showed the superiority of oleic over the stearic acid soaps, while Stockholm tar also proved very satisfactory ; the good qualities of the latter product and of the oleic acid soaps were not diminished by use with acid arsenite as recommended in the Government formula. Further, Stockholm tar did not lose its emulsifying power to the same extent as other emulsifying agents when the dip was made up with hard water, and for that reason should be a valuable ingredient in dipping fluids.

The conversion of arsenite to arsenate on keeping was also investigated. This process had occurred in about 25 per cent. of the dips examined during the three previous years ; it decreases the value of the dip, as the tick-killing property of the arsenate is only about half that of the arsenite. A series of tests was made, in which *a*) pure arsenite solution, and *b*) an arsenite solution containing tar and soap and approximating to the Government formula, received a small amount of nutritive material, were sterilized, inoculated with oxidised dipping fluid and incubated under various conditions of illumination. The results were as follows :

1. Pure arsenite solutions under sterile conditions remained unoxidised in darkness or in diffused light, but underwent marked oxidation in direct sunlight.

2. In the presence of tar, sterile arsenite solutions underwent marked oxidation in darkness ; in diffused light and direct sunlight the oxidation was still more marked.

3. The oxidation of arsenious to arsenic acid was also effected by bacterial agency ; the oxidising bacteria seemed to be equally active both in light and in darkness, but there appeared to be a marked difference in the activity of different strains of organisms.

4. Tar, apart from its effect in itself inducing oxidation, appeared to exert an inhibitive effect on the activity of oxidising bacteria, and this inhibitive effect seemed to be exerted to a greater extent in sunlight, direct sunlight in tar solution almost completely preventing the activity of certain strains of bacteria.

5. Bactericides, such as mercuric cyanide and formalin, were effective in preventing growth of oxidising organisms, and bacterial activity was necessarily not evident except in presence of nutritive material.

In the 75 per cent. of cases in which oxidation does not occur in dipping fluids, it has been suggested that the apparent inhibition is due to the agency of organisms capable of reducing arsenic to arsenious acid. In order to test this point, sterile arsenate solutions, with and without tar and soap, provided with nutritive material and equivalent to 0.2 per cent. As_2O_3, were inoculated with various media likely to gain access to dipping fluids in dipping practice (dung, soil, grass, etc.); they were maintained under conditions of light and complete darkness during periods of two and four weeks, when they were examined for arsenic in the reduced form of arsenite. Reduction was found to have taken place in all cases where tar and soap were present, but only in a few cases where tar and soap were absent; it would thus appear that the tar has a less well marked inhibitive effect on reducing than on oxidising bacteria and that the former only gain the upper hand when the latter have been weakened. The maintenance of the arsenite concentration of dipping fluids would therefore seem to rest mainly on the growth and activity of organisms capable of preserving it in opposition to the oxidising influence of tar, light and the opposing oxidising bacteria; the determination of the environmental conditions most conducive to their multiplication presents the most promising field for further investigation.

For the present the recommendations for cleaning out dips, when the dipping-fluids show persistent rapid oxidation, are to empty and cleanse thoroughly, spray walls, woodwork and dripping yards with formalin solution, whitewash dip and timber, and allow at least a week's interval before recharging.

II. — In South Africa the most dangerous cattle disease of recent years is the East Coast fever caused by a blood parasite, *Theileria parva*, which was introduced in 1902 from German East Africa. This parasite develops in the lymphatic organs, whence, on attaining maturity, it passes into the blood corpuscles. According to the writer the disease is spread by ticks, especially by the brown tick (*Rhipicephalus appendiculatus*) which has three hosts, and the red tick (*R. evertsii*) with two hosts; but the black tick (*R. Simus*) and the blue tick (*Boophilus decoloratus*) may also be considered as carriers of the disease. The writer gives a short description of the life history of each of these ticks.

For the prevention and cure of the disease, the first thing is the destruction of the ticks, but it took a considerable time for this desideratum to be adopted in practice. An impulse in this direction was given by the steady spread of the Coast fever in Natal, where the measures successfully

dopted in the Transvaal were of no avail. At first it was tried to dip the nimals once every four weeks in an arsenical fluid, but as no effect ollowed, the interval between the successive dips was shortened to three, wo and one week, without however obtaining any better results. Whereupon PITCHFORD experimented in Natal with dips repeated every five and hen every three days and found that with three-day intervals the disease ould be stopped. The efficacy of the latter method lies in the fact that nfection in cattle sets in between 60 and 120 hours after the ticks have astened on to their hosts.

The composition of the dip originally recommended by PITCHFORD was 8 ½ lbs. sodium arsenite, 5 ½ lbs. soft soap, 2 gallons petroleum and 400 gals. water. It was later discovered that the dip was more efficient without petroleum or soap.

For dips repeated at short intervals, farmers in South Africa use commonly 4 to 4 ½ lbs. of the arsenic salt to 400 gallons of water. When the animals are dipped at longer intervals the proportion of arsenic is correspondingly increased.

On the occurrence of an outbreak of the disease dipping must be continued until the ticks living in the grass have been starved to death this may require as much as 14 months. As a general rule all the animals that are out grazing must be dipped, including pregnant cows and calves. Horses, sheep and pigs are not so frequently dipped as cattle. The average time required for each animal does not exceed 6 seconds.

As secondary effects of these dips, a temporary diminution of the milk yield of the cows and of the capacity for work of the oxen are generally noted in South Africa, but no cases of poisoning through drinking the arsenical liquid while dipping have been observed.

The ticks begin to diminish after the first dip; the first to die are those that are not fully gorged, the last the fully gorged ones. The parts of the tody that are first freed from the ticks are the udder, the insides of the bhighs and the barrel. The most easily destroyed ticks are the one-host blue ticks, the most difficult to eradicate are the two-host red ones. Besides Coast fever, all the other diseases which are spread by ticks in South Africa, such as Texas fever, anaplasmosis and the like, are controlled wherever arsenic dips are practised. Besides which, in many localities, the mortality among calves has been considerably reduced. The disappearance of white scour in calves and of a contagious inflammation of the eyes in cattle caused by *Filaria lacrymalis* wherever arsenic dips have been used, has been remarkable.

The only drawback that can be mentioned in connection with these dips is that the young animals can no longer be immunized against Texas fever and anaplasmosis.

The writer concludes with the observation that the use of arsenic dips in South Africa has solved at one stroke the problem of the prevention and cure of all diseases transmitted by ticks.

ANATOMY AND PHYSIOLOGY

1020 – **The Effect on the Milk Glands of Volatile Fatty Acids from the Food.** — BEGER, C. in *Die landwirtschaftlichen Versuchs-Stationen*, Vol. 85, Part 1-2, pp. 155-163. Berlin, August 3, 1914.

The writer gave alternately to two goats, together with a certain basal ration, first an oil having a very high Reichert-Meissl value (guinea-pig cheek oil) and then one with a very low R. M. value (earthnut oil) and observed to what extent the addition of volatile fatty acids to the fodder acted upon the R. M. value of the butterfat and generally upon lactation.

The two animals experimented upon were of the same breed and in an advanced period of lactation. The experiments showed that the addition of volatile fatty acids to the fodder had no sensible effect upon the R. M. value of the butterfat, but that it had a stimulating effect upon the absolute quantity of milk and upon its composition.

Though the guinea-pig cheek oil is a fat which owing to its specific characters (it consists chiefly of valerianic acid) does not pass directly into the milk glands and thence into the milk fat, it must contain other substances similar to the components of milk which act favourably on the nutrition of the milk glands. It can consequently be assumed that in the fat contained in food there are substances which can act as stimulants upon the milk glands independently of their nutritive value.

According to the writer the composition of the milk fat seems to be influenced only by such components of the fat in the food as already exist in the milk. The milk glands have the power of rejecting those substances which do not already exist in the milk or of utilizing them only under quite special conditions. In consequence of this fact the writer does not think that experiments with iodized or coloured fats made with the object of determining the passage of fats contained in the food into the milk can give conclusive results. The udder decomposes the available material and then selects among these components. The loosely combined iodine and similar substances are probably first separated, after which they act as if they had not been joined to the fat.

FEEDS AND FEEDING

1021 – **The Presence of Arsenic and Manganese in some Feeding Stuffs.** — JADEN, F., and ASTRUC, A., in *Comptes Rendus hebdomadaires des Séances de l'Académie des Sciences*, Vol. 159, No. 3, pp. 268-270. Paris, July 20, 1914.

The presence of minute quantities of arsenic and manganese in animal tissues has previously been recorded. The same fact has now been proved in the case of vegetable tissues. In order to show the source of supply of the arsenic and manganese in animals, the writers have determined their presence and percentage in the more common feeding stuffs. The results are shown in the accompanying table.

Forage.	Composition		Manganese		Arsenic
	Water	Ash	Mgms. per 100 gms. of dry matter	Mgms. per 100 gms. of ash	Mgms. per 100 gms. of dry matter
Medicago sativa	64.00	3.35	5.00	53.73	0.050
Hedysarum humile	73.50	2.00	4.33	57.50	0.056
Vicia sativa	62.90	4.75	2.68	21.05	0.054
Trifolium pratense	67.50	3.55	5.38	49.29	0.037
Solanum tuberosum	74.46	0.85	0.14	4.23	0.031
Beta vulgaris	91.83	1.16	1.63	11.43	0.061
Populus nigra	64.20	2.48	17.46	322.58	0.019
Castanea vulgaris	55.45	1.00	1.56	140.00	0.011
Oryza sativa	13.66	1.11	0.93	72.00	0.008
Zea Mays (seed)	17.65	1.52	1.94	105.26	0.036
Zea Mays (stems and leaves)	85.50	1.45	4.13	41.37	0.027
Hordeum distichum	10.06	2.60	3.78	130.76	0.055
Avena sativa	19.66	2.99	4.97	133.77	0.062
Bran	17.20	4.74	8.59	150.21	0.012
Grass (1)	52.75	6.80	16.93	117.64	0.053

(1) Consisting of 96-98 per cent. Gramineae, the species present being: *Anthoxanthum odoratum, Holcus mollis, Agrostis canina, Lolium perenne, Ranunculus acris, Cerastium brachypetalum, Linum angustifolium, Trifolium minus.*

1022 – **The Bacterial Flora of Some Fresh or Fermenting Concentrated Foods and its Effect on Milk.** — WIGGER, A., in *Centralblatt für Bakteriologie, Parasitenkunde und Infektionskrankheiten*, Vol. 41, No. 1-8, pp. 1-227. Jena, May 27, 1914.

The three concentrated foods most frequently used in Switzerland, namely bran, earthnut meal or cake, and sesame meal or cake, were examined. The fodder containing the highest number of germs was bran, which, as an average of 15 samples, contained 6 million germs per gram. Earthnut meal and cake contained, as an average of 18 samples, 1 ¼ million. Sesame meal and cake, average of 24 samples, contained about ½ a million per gram.

Pollards were by 57.5 per cent. richer in germs than bran. Earthnut cake contained more of them than the meal, while, with sesame no difference in this respect was found to exist between the cake and the meal. The variation in the germ content of the individual fresh samples was relatively greatest in bran and smallest in sesame.

The bacteria in the fresh sesame and earthnut foods are much the same, and much richer in species than in bran. The latter contained 21 different species of schizomycetes, earthnut concentrates 44, and sesame 48. As typical species in bran the writer found: *Bact. coli*, var. *luteoliquefaciens* Lehmann and Levy, yellow acid producers Levy (1), *Bact. herbi-*

(1) Not yet named in Latin. (*Ed.*).

cola aureum Burri and Duggeli, and *B. fluorescens liquefaciens* Lehmann and Neumann. The earthnut foods contained in prevalence *Bact. mesentericum vulgatus* Flügge, *B. subtilis* Cohen, *B. coli* var. *luteoliquefaciens* L. and L., yellow acid producer Levy, and gas-forming lactic acid bacteria. As typical sesame bacteria the following were found: *Bact. mesentericus vulgatus* Flügge, *B. subtilis Colon*, *B. coli* var. *luteoliquefaciens* L. and L., yellow acid producers, gas producers and cocci.

In moistened concentrates the number of germs increases to an extraordinary degree and at 37° C. after 24 hours reaches its maximum, after which it sinks. During this time there is such a constant change in the nature of the flora that the fermentation may be considered as a metabiotic process. The changes thus brought about are, during the first days, principally a lactic acid fermentation; later more mixed fermentations prevail. The former was more clearly visible in the earthnut foods and less so in the sesame. Fluorescent bacteria are fairly common in both.

The typical bacterium of putrefaction, *Bact. putrificus coli*, is especially abundant in earthnut meal and cake (in 55 per cent. of the samples), in bran rarer. Through the multiplication of these bacteria, the concentrated food can undergo such changes that animals refuse to eat it, or if it is eaten it produces symptoms of poisoning, as the writer proved by examples. He has found in bran also the virulent bacillus of anthrax, as he was able to demonstrate experimentally on animals. Thus the sudden unexpected breaking out of anthrax may be explained in many cases.

As for the influence of these feeds, fresh or fermented, on the bacterial contents of milk, the writer says that small contaminations with them at normal temperatures have no noticeable effect upon the fermentation of milk, but at higher temperatures, 37° C. (98.6° F.), changes in the milk and the evolution of gas are accelerated. In dirty milk or in ordinary somewhat older milk, small additions of these concentrates do not cause noticeable differences in the bacterial content, while in sterilized milk the changes brought about by such additions are somewhat more marked.

1023 – **The Food Value of the Jack Bean *(Canavalia ensiformis)*** (1). — BARNSTEIN, F., in *Die landwirtschaftlichen Versuchsstationen*, Vol. 85, Part 1-2, pp. 113-122. Berlin, August 3, 1914.

The Jack bean (*Canavalia ensiformis*) is a leguminous plant cultivated in German East Africa and in many other tropical countries and distinguished by its abundant yield and great resistance. On account of its abundant yield attempts have been made in German East Africa to utilize the seeds in the country itself and also to export them.

Notwithstanding that a certain quantity of these beans are exported to Hamburg, their sale abroad has not hitherto amounted to much.

The chief obstacles to their utilization in the German East African protectorate are that the natives, not knowing the plant, are not inclined to eat the seeds, and that it is not yet well known whether the beans are poisonous, as is believed in many localities, or not. If they are found

(1) See also No. 498, *B.* May 1913. (*Ed.*).

o be harmless, they may be of considerable importance as a feedingstuff, ince they are very rich in nutritive material.

Chemical analyses of Jack beans were carried out by BONAME in 1911, nd they give the following composition for seeds and pods :

	Seeds	Pods
	percentage	
Water	13	15.2
Protein	25.62	5
Fat	2.32	0.64
Crude fibre	7.9	57.91
N-free extract	47.94	15.47
Ash	3.22	5.78

According to a recent analysis by the writer the seed in its original condition contains :

Water	13.16 per cent.
Crude protein	31.51 »
Pure protein	24.82 »
Fat	2.18 »
N-free extract	41.99 »
Crude fibre	8.59 »
Ash	2.47 »

The digestibility of the beans as it resulted from a four-weeks test carried out by the writer on two young sheep was as follows :

Dry matter	87.5 per cent.
Organic matter	88.6 »
Crude protein	80.5 »
Crude fat	72.1 »
N-free extract	99.1 »
Crude fibre	72.9 »

With these coefficients of digestibility, the starch value works out at 63.7 per cent., with 18.69 digestible pure protein. The jack bean stands thus, as regards its nutritive value, somewhat lower than the common field bean, which according to Kellner has a starch value of 66.6 per cent. and 19.3 per cent. digestible pure protein.

During the experiment the animals were given the relatively high ration of 0.44 lb. of crushed beans, without apparently suffering any ill effects. Of course it would be premature to draw the conclusion that these beans, under all conditions, are a harmless fodder and it would be advisable to repeat the experiments.

1024 – **Has the Dry Matter in the Various Root Crops the Same Food Value?** — HANSSON, NILS, in *Mitteilungen der Zentralanstalt für das landwirtschaftliche Versuchswesen in Schweden*, pp. 11-12. Stockholm, 1914.

During the winter half-years 1908-09 and 1909-10 exhaustive feeding experiments were carried out with the object of determining whether the current assumption that the dry matter in the various root crops has the same value is correct or not. Thirty milch-cows were used, and divi-

ded into five equal groups. In the preparatory period they were all fed 66 lbs. of Bortfeld turnips per diem. During the time that the experiment proper lasted, about 1½ months, one group continued to be fed with the usual turnips, and the other groups were given other roots containing the same amount of dry matter. The rations of the various groups per head and per day were as follows :

Group	I	66	lbs.	Bortfeld turnips
»	II	36.70	»	Sarunner »
»	III	33.66	»	Hellrothe Flasche mangolds
»	IV	40.04	»	Swedes
»	V	41.80	»	Eckendorf mangolds

Owing to the different content of dry matter, the quantity of roots fed varied, the dry matter in all cases being 5.28 lbs. per head per day.

The experiment showed that the substitution of one root for another did not cause any appreciable difference in the milk yield nor in its fat content. The live weight of the cows was also not affected. The conclusion can thus be drawn that the dry matter in the various roots has practically the same food value.

1025 – **Common Salt as a Poison for Stock.** — GUTHRIE, F. R., in *The Agricultural Gazette of New South Wales*, Vol. XXV, Part 8, pp. 663-664. Sydney, August 3, 1914.

Although a certain amount of salt is a necessary adjunct to the food of animals, an excessive quantity is injurious.

In the case of pigs and sheep, 4 to 8 ounces is said to have produced poisoning (see LANDER, *Veterinary Toxicology*, 1912). In larger quantities it has proved fatal to horses and even to cattle. Fowls would appear to be particularly susceptible. According to experiments conducted by LUFFRAN, 4 grams per kilo live weight are fatal if injected in solution into the crop. Recently several instances have been brought under the notice of the Department of Agriculture of New South Wales, in which the deaths of poultry and pigs have been traced to an excessive amount of salt in the food. In a fowl which had died suddenly, the contents of the crop weighed 50 gms. and were found to contain 2.42 gms. of salt, or 4.84 per cent.

The Department therefore warns farmers of the necessity of care in using certain foods found on the market. One sample of pollard was discovered to contain no less than 32.2 per cent. by weight of common salt. Other samples contained varying amounts down to 5.8 per cent. One case of poisoning of pigs was reported, and it was found that the food supplied to them was a mixture of pollard, barley meal and 11.66 per cent. of salt.

The toxic effect of salt appears to be due to its action on the muscles, so that the animal becomes unable to walk and, finally, to stand. Death is caused by asphyxia, due to loss of power in the respiratory muscles.

26 – **Scale of Points for Judging a mixed Dairy Farm.** — *The Agricultural Gazette of New South Wales*, Vol. XXV, Part 2, p. 106. Sydney, February 1914.

An Agricultural Association wrote to the Department of Agriculture New South Wales asking for a scale of points suitable for a competition farms including dairying. Two experts of the Department compiled the llowing classification :

	Points	
A. *Management :*		
1. Checking production and quality of dairy produce and the working of dairy machinery	25	
2. Supervising, feeding and watering of stock ; making provision of fodder and pastures (calf feeding methods to have special attention)	30	
3. Attention to breeding with a view to improving yields and supply of heifers for the future; supervising with a view to disease prevention in calves, cows, etc.	35	
4. Book-keeping and milk record keeping; stud books for cattle and pigs	10	
		100
B. *Stock :*		
1. Cattle, quality and type, taking into consideration the character of land and purposes for which cattle are used, *viz.* cheese, butter or town milk supply. Milk and butter yields to be taken into account	100	
2. Pigs	30	
3. Horses	15	
4. Poultry	5	
		150
C. *Crops, including rotation, cultivation methods and manuring:*		
1. Most suitable fodder crops for dairy cattle	15	
2. Other crops	15	
3. Yield	15	
4. System of cultivation, including manuring methods, rotation and cleanliness of crop	15	
5. Freedom from disease in crop	8	
6. Trueness to type	7	
		75
D. *Pastures :*		
1. Improvement of pastures ; most suitable grasses, sown according to locality ; grass experiment plots	50	
2. Subdivision into most suitable paddocks	25	
		75
E. *Buildings and Fences :*		
1. Dairy and bails	18	
2. Homestead	12	
3. Piggery and poultry farm	10	
4. Fences and gates	10	
		50
F. *Machinery and Tools*		50
Grand Total		500 points

1027 – **Some Data on the Animal Products and the Control of Rabbits in N South Wales, 1913.** — JACKSON, H. V., in *The Agricultural Gazette of New So Wales*, Vol. XXV, Part 6, pp. 504-506. Sydney, June 1914.

During the year ending 31st December 1913 the value of the anim products exported from New South Wales was as follows:

	£
Wool	11 699 858
Meats: Beef	247 934
Mutton and Lamb	1 215 878
Rabbits and Hares	373 633
Preserved	575 855
Tallow	1 002 076
Skins: Hides	910 609
Sheep	439 525
Rabbit and Hare	310 694
Other	612 812
Leather	369 210
Butter	988 143
Live animals	54 098

The number of rabbits exported was 13 556 160 head; the hares 325 77

The number of poultry on farms of 1 acre and upwards, at the en of 1912, was 3 351 000 fowls, 261 100 ducks, 23 900 geese, 216 300 turkeys 6000 other birds. The estimated number of eggs obtained during the yea was 13 769 000 dozen. During the season 1913-14, 476 312 dozen eggs were held in cool stores. In addition there were also stored 9 802 tins o pulped eggs of 40 dozen each.

CATTLE

1028 – **Comparison between the Observed and Calculated Production of Heat in Cattle.** — PRENTISS, ARMSBY HENRY, in *Landwirtschaftliche Jahrbücher*, Vol. 46, Part 5, pp. 753-759, Berlin July 14, 1914.

After a review of the experiments of RUBNER, LAULANIE, ATWATER and BENEDICT, and BENEDICT and MILNER, all of whom have shown that the relations between chemical, thermic and mechanical energy are the same in man and in carnivora as everywhere in nature, the writer reports upon his own experiments on herbivorous animals, which have been carried out as usual by measuring the production of heat by means of a respiratory calorimeter (Atwater-Rosa system) and then comparing the results with the production of heat calculated from the balance of the nutritive elements. Altogether 57 experiments with oxen, nearly or quite mature, have been carried out since 1902, the results of which are available for comparison. They show, as was to be expected, that the results of the individual experiments do not always agree perfectly with the requirements of the law on the conservation of energy. The greatest deviations were + 7.6 per cent. and — 5.1 per cent. The average of the 57 experiments, however, shows that the observed production of heat differs from the calculated heat only by 0.4 per cent. This difference is about the same as that found by the above-mentioned observers.

The conclusion is thus justified that in herbivorous animals the same relations between chemical, thermic and mechanical energy exist as in carnivora and in nature generally.

029 – **Calf Rearing Experiments in Hungary.** — KEREKES, GÉZA, in *Köztelek*; Year 24, No. 61, pp. 2172-2173. Budapest, August 15, 1914.

These experiments were carried out with 18 calves on the Vitka farm belonging to Count Károlyi. One batch of animals was fed on separated milk, the cream being replaced by rye flour: the writer was led to make this choice on the principle that carbohydrates can take the place of fats in animal nutrition. The flour was given at the rate of first 4 oz., later 5 oz. per gallon of separated milk, the formation of lumps being avoided by vigorous turning in a churn. The emulsion was then warmed to the temperature of the cow's udder.

The 18 calves were divided into two groups, one of which (Group I) was fed naturally, while the other (Group II) received the following treatment during four successive periods: 1) whole milk up to the age of 4 weeks; 2) gradual substitution of whole milk by the emulsion until the quantity of flour reached 5 oz. per gallon at the end of about 8 weeks; 3) milk emulsion with a gradual reduction in the quantity of flour toward the end of the period, *viz.* to about 3 months old; 4) separated milk at the rate of 2 ¼ to 2 ½ gallons per calf daily. The determination of the rations during the three earlier periods was based on the eighth part of the live-weight of the animals, which were weighed each week.

Table I gives the live-weight of the calves at birth and at 12 weeks. During the 4th period the artificially fed calves continued to drink their daily allowance of separated milk, whilst all except three of the calves of the other group refused to take skimmed milk when taken off whole milk at three months (see Table II).

TABLE I. *Weight of calves at birth and at 3 months (lbs).*

Group II			Group I		
Nos. of calves	Weight at birth	Weight at 3 months	Nos. of calves	Weight at birth	Weight at 3 months
55	73	317	115	70	211
60	75	251	88	75	233
61	77	258	116	77	249
26	79	348	7	82	229
144	79	293	86	86	266
77	84	326	85	88	260
19	86	266	118	88	269
14	86	306	59	88	
12	88	306	198	93	231
Average	80.6	297.5	Average	82.9	248.2

TABLE II. — *Weight of calves at 4 months (lbs.).*

Group I		Group II		Remarks
Nos. of calves	Weight	Nos. of calves	Weight	
55	401	115	253	refused milk
60	353	88	271	»
61	337	116	306	»
26	417	7	287	»
144	375	86	311	»
77	397	85	335	took milk
19	366	118	359	»
14	386	59	353	»
12	390	198	271	refused milk
Average	380.0	Average	305.0	

TABLE III. — *Average weehly rations per calf from the 1st to the 12th week.*

Period	Group I	Group II		
	whole milk — gals.	whole milk — gals.	separated milk — gals.	rye flour — lbs.
1st week	. . . . . Colostrum			
2	7.2	7.2	—	—
3	8.0	8.0	—	—
4	9.2	9.2	—	—
5	10.5	8.8	1.7	0.42
6	13.1	9.9	3.2	1.17
7	14.2	7.9	6.2	1.87
8	15.4	3.1	12.3	3.70
9	16.6	—	16.6	5.00
10	12.5	—	12.5	3.74
11	7.8	—	7.8	2.35
12	4.6	—	4.6	1.14
Totals . . .	119.2	54.2	65.0	19.41

Omitting the cost of hay and oatmeal, which was the same in both groups, the cost of feeding works out as follows:

Whole milk calves:

119 gals. at 1 *s* 1 ½ *d* per gal.	£6	15 *s*	
Emulsion calves:			
54.2 gals. of whole milk at 1 *s* 1 ½ *d*	£3	1 *s*	7 *d*
65 » » separated milk at 3.6 *d*		19	8
19.4 lbs of rye flour at 1.1 *d*		1	9
	£4	3 *s*	0 *d*

Thus the difference is £2 12 *s* in favour of artificial feeding.

These figures show a considerable economy.

1030 – **Indian Cattle in the Philippines.** — EDWARDS, C. W., in *The Philippine Agricultural Review*, Vol. VII, No. 7, pp. 288-291 + 2 plates. Manila, July 1914.

The Philippine Archipelago, with its extensive pasture area, abundant water supply and tropical climate, is principally a live-stock country; nevertheless there is a great deficiency of both meat and work stock. This state of things cannot well be remedied by the importation of animals from abroad, as these would be more liable than the native cattle to the diseases that have caused the depletion in numbers. On the other hand the lack of good local breeds is a serious obstacle to the improvement of the native cattle. A considerable amount has been spent in an effort to raise pure-bred European and American cattle and their crosses with the native stock, but, except in a few cases, the attempt to raise pure-breds has failed, and the crosses, while showing good conformation and size, were more susceptible to disease. In fact this has been the general experience throughout the Tropics under natural range conditions. Considerable numbers of cattle have been introduced from tropical China and Indo-China, but they, and especially the former, are susceptible to rinderpest and are not in general as great an improvement as would be desirable, as they are lacking in the prepotency of their characters.

Of recent years Zebus from British India have been imported into the Philippines and successful results have been obtained in breeding both pure-breds and crosses.

Lieut. Col. W. D. Gunn, formerly superintendent of the civil veterinary department, Madras, distinguishes seven principal breeds of Zebu (*Bos indicus*) cattle:

1. Mysore breed or Amrat Mahal.
2. Mahadeswarabetta or Alumbadi.
3. Ongole or Nellore.
4. Kangayan.
5. Pulikolum, Jellicut.
6. Kappliyan.
7. Gumsur.

Of these breeds the most important are the Ongoles and Mysores; the former are particularly noted for their suitability for heavy draught and the latter for their extremely hard feet and aptitude for road work. The Ongole is bred in greatest numbers in the Guntur district, Madras presi-

dency. This breed has been imported into Brazil, Argentina, Java and Africa and a few into the United States, particularly into Texas. It is the only breed with which any definite breeding experiments have been carried on in the Philippines. It has been imported by local dealers and by the Bureau of Agriculture, which experimented with these cattle at the La Carlota station, Occidental Negros Province, at the Trinidad stock farm, Benguet, in the subprovince of Bukidnon, and at Alabang.

The results have been excellent. These animals showed a high resistance or apparent nearly complete immunity to rinderpest, immunity to tick-fever and a resistance to insect pests nearly equal to that of the native animals. In all sections execepting those at high altitudes where the temperature is comparatively low during the rainy season, these animals have exhibited remarkable qualities of thrift and hardiness, superior to those of the native stock; they have proved also successful for road and light field work. Their crosses with the native stock are highly resistant to rinderpest; they are a great improvement in size and conformation over the native dams and exhibit to a great degree most of the desirable characters of their Zebu parents.

In many respects Indian cattle are not to be compared with improved European and American breeds, but they are far better adapted to existing conditions in the Philippines.

PIGS

1031 – **Rearing Pigs in Movable Pens.** — HVENEGAARD, M., in *Gaceta Rural*, Year 8, No. 85, pp. 37-45 + 9 figs. Buenos Aires, August 1914.

The writer has obtained very good results in the Argentine with a system of rearing pigs in movable pens; he has obtained an average of 12 pigs per sow per annum with a herd of 1000 sows.

The pen measures 9 ft. 9 in. by 6 ft. 6 in. and is 2 ft. 9 in. high; it is made of six 2 in. × 3 in. uprights to which are nailed four rows of 1 in × 3 in. bars, 7 ½ in. apart; shelter is provided by a piece of corrugated iron at one end sloping from the top bar to the second bar and by two other pieces fixed to the lower three bars below it. The 7 ½ in. space allows the young pigs to pass to and fro. A trough of 5 gallons capacity is placed in each pen. The cost of such a pen does not exceed 15 pesos (about 26*s*).

The pens are placed in lucerne fields 20 yds. apart in rows 120 yds. apart. Litters of different ages should not be allowed in the same row, or the bigger ones will enter the pens of the younger and interfere with their sucking. When breeding is carried out all through the year, 100 pens are sufficient for 300 sows. After the pigs are weaned the sows are allowed to pasture with the boar (1 boar for each 25 to 30 sows) and the sows near farrowing are removed to the pens each week.

The pens are moved each day to provide fresh clean pasture; three men can move 100 pens in an hour. Fresh water is supplied each morning and about 7lbs. of maize is allowed each sow in the afternoon. Weaning takes place at the age of 2 ½ to 3 months, and to simplify the work it is better to wean those of a row at the same time. After weaning the males are castrated, and all are marked and given an insecticidal bath. They are then put out to pasture until 1 year old.

At least one shed 25 yds. × 6 yds. should be provided for every 1000 pigs to afford them shelter in bad weather. From $^3/_4$ to 1 lb. of maize per head is allowed daily. At one year old they should weigh about 110 to 150 lbs.; they may then be fattened if desired by turning them into a maize field. With a good crop of maize 250 acres will fatten 1000 pigs in 2 to 4 months. During this period the fattest are chosen and sent to the market. If possible the crops should be arranged so that the lucerne fields surround the maize crop, thus enabling the pigs to prevent an attack of locusts.

The economics of this system under Argentine conditions are as follows (taking the dollar at 1*s* 9*d*):

	£
Capital Expenditure:	
6 200 acres at about £5 12*s*	35 000
Buildings, etc.	8 750
1 000 sows at £3 10*s*	3 500
40 boars at £8 15*s*	350
First year's expenses	6 562
Total £	54 162
Annual Expenditure:	
Interest on capital at 8 %	4 333
Labour; 8 or 10 peons	875
Maize for rearing purposes	3 500
Cultivation of 2 200 acres of maize for fattening	1 312
Sundry expenses	1 355
£	11 375
Receipts:	
10 000 pigs, weighing 220 lbs. each	29 875
Profit £	17 500

1032 – **Comparative Experiments on Pigs in the State-subventioned Breeding Districts of Denmark.** — *Eighty-fifth Report of the Royal Veterinary and Agricultural College in Copenhagen.*

In Denmark there are practically only two breeds of pigs: the Danish and the Large White Yorkshire.

The Danish breed, to which by far the majority of the pigs in the country belong, is the most resistant and prolific, and its offspring possess the greatest vitality, but at the slaughterhouse it is inferior to the Large White, which is especially good in this respect. A good breeding animal is produced by crossing the two breeds.

But the greatest efforts are being made to improve the native breed by selection and pure breeding, and encouragement for this is given in various ways, the chief of which is the granting by the State of a moderate yearly sum to owners of herds of pure-bred well built animals who are disposed to breed the pure strains and to place their herds under public control; for this, besides the grant, they get recognition from the State as belonging to a breeding district.

Such districts have been created for natives and for Yorks; in 1914 there were, in Denmark, 83 for the former, from which mostly young sows are sold, and 22 for the latter, which chiefly sell young boars.

In order to obtain abundant data on the development of the breeds and on their qualities, three control and experiment stations for pigs have been founded, where the offspring of the selected breeding animals (the only animals that the breeding district is empowered to sell) are fattened and slaughtered under State control. One of the conditions for the recognition and the grant is that the breeder obliges himself to sell every year two young pigs from each selected sow to the local experiment station at the current market price. A group of young pigs for experiments (4 head) consists, as a rule, of 4 animals of the same litter and when possible of two females and two males.

Every year a Report is issued on the results obtained at the experiment stations; the present is the fifth such Report. The result of the experiments is to the effect that the development of the two breeds is nearly the same, while the local breed is inferior at the slaughterhouse test, especially as regards hams and sides; the Yorks yield about 2 per cent. more bacon for exportation (thus less offal) than the native pig. In both breeds about 1.1 lb. of increase was obtained from 3 3/4 food units. The age of the pigs when slaughtered (weight about 198 lbs.) was on the average barely 200 days.

POULTRY

1033 – **Poultry Conditions in Indiana.** — PHILIPS, A. G. (Division of Poultry, Department of Animal Husbandry) in *Purdue University, Agricultural Experiment Station, Circular* No. 40, pp. 32 + 20 figs. Lafayette, Indiana.

The following figures are taken from the Fourteenth Biennial Report of the Department of Statistics of Indiana for 1911-12, but they do not ever show the whole value of the poultry raised because they do not include the numbers of hens kept inside town and city limits.

No. dozen eggs produced in 1910		68 672 724	
» » » » » 1900		38 987 348	
Increase . . .		29 685 376	or 76 per cent.

1911. — No. poultry sold	7 425 144	value	$	3 146 143
» laying hens on hand . . .	9 530 220	»	»	3 938 933
» ducks, turkeys, geese on hand	209 604	»	»	124 973
Total . . .			$	7 210 049
No. dozen eggs. produced 69 690 104		value	»	13 130 407
Grand total			$	20 340 456

Average value per dozen: 18 cents.
Average egg production per hen: 87.7 eggs.

Poultry keeping is especially developed in White, Kosciusko, Allen Adams, Cass, Jay, Randolph, Ripley and Grant counties.

Two thousand lists of questions were sent out in the State by the Purdue University Agricultural Experiment Station and elicited 704 answers. From these it appears that 704 farmers kept 94 589 fowls, or an average of

134.5 per farm; the average value of each bird is 42 cents so that the farmer's average investment in fowls is only $ 56.49. About one half of the birds are pure bred. For small farms Plymouth Rocks are most popular, while for the larger ones Leghorns seem to be preferred.

From the monthly records submitted to the Poultry Department of the Experiment Station by farmers of the State, it is found that where Leghorns, Plymouth Rocks, Wyandottes or Rhode Island Reds were fed grain only, the average egg production ran from 52 to 70 eggs per hen per year. Where mill by-products, and meat scraps or milk were added, with these same breeds the minimum production was 66 eggs and the maximum 124, most of them averaging over 85.

In 1911 and 1912 at the Purdue Experiment Station an experiment has been carried out with Leghorn pullets in which all pens were fed corn, wheat, oats, bran and shorts in the same proportion. One pen had in addition 10 per cent. meat scraps, and another pen sufficient skim milk to equalize the amount of protein contained in the meat scraps. In reality this meant about as much milk as the chickens would drink. The result of the two years' work was that the meat scrap pen produced an average of 135 eggs per year per hen, the skim milk pen 135.5, and the pen without meat or milk 36 eggs per bird per year. The cost of feed per hen was respectively $ 0.915, 1.085 and 0.73.

In the pen receiving milk, the egg production through the winter months (December-February) averaged almost seven per cent. more than in the pen fed meat scrap. For every $ 2.50 invested in 100 lbs. meat scraps there was $ 24.50 return and for every 30 cents invested in 100 lbs. of skim milk $ 1.73 was returned.

About one third of the farmers that answered the questions use incubators.

At the Purdue Experiment Station good results have been obtained from brooders. The best results have not been obtained from lamp-heated brooders but by a wooden brooder house heated by a gasoline burner. This brooder is an eight-foot square colony house 6 ft. 6 in. high to the comb with an A-shaped roof, placed on runners so that it can easily be moved. The wood and material for such a house will cost about $ 15 and the heater $ 11.

1034 – **Egg-Laying Competitions in Australia.** — I. Egg-laying Tests at the Hawkesbury Agricultural College, Twelfth Year's Results. — *The Agricultural Gazette of New South Wales*, Vol. XXV, Part 5, pp. 421-433 + 2 plates. Sydney, May 1914. — II. HART, A. (Chief Poultry Expert) Report on third Egg-laying Competition at Burnley, 1913-14. *The Journal of the Department of Agriculture of Victoria*, Vol. XII, Part 6, pp. 353-362 + 7 figs. Melbourne, June 1914.

I. — *Twelve years of egg-laying tests at the Hawkesbury Agricultural College.*

In the accompanying table are summarized the results of the twelve years of egg-laying competitions, the last of which concluded on March 31, 1914.

In this year the innovation introduced was the single-pen system of testing individual hens in groups of six, and it revealed great individual differences; for instance in one group the best laid 224 eggs, the worst 188, and five exceeded 200. The test of judgment in selection, in which ten breeders supplied duplicate pens of six hens each, selected respectively as "good" and "bad" layers, confirmed the results of the preceding year, the average laying of the "good" pens being 14 eggs, and the value 1*s* 8*d* per hen per annum more than the "bad" ones. The winner of this section was able to select hens that gave a return of £ 1 8*s* 7*d* more than his six "bad" hens.

In the 1913-14 competition in all the sections, 660 birds took part. The breeds represented were: White Leghorns, Brown Leghorns, Black Orpingtons (one group of which exceeded the collective total of any other pen of heavy breeds), Silver Wyandottes, White Wyandottes, Minorcas, Plymouth Rocks, and Langshans.

	Winning total	Lowest* total	Average per hen	Average value per hen		Cost of feed per hen		Profit over feed	
				s.	*d.*	*s.*	*d.*	*s.*	*d.*
1st	1 113	459	130	15	6	6	0	9	6
2nd	1 308	660	163	17	9	5	9	12	0
3th	1 224	532	152	12	9	4	6	8	3
4th	1 411	635	166	13	3	5	3	8	0
5th	1 481	721	171	14	10	5	10	9	0
6th	1 474	665	173	17	2	7	0	10	2
7th	1 379	656	180	19	2	7	10	11	4
8th	1 394	739	181	21	9	6	9	15	0
9th	1 321	658	168	16	6	6	4	10	2
10th	1 389	687	184	18	5	6	1	12	4
11th	1 461	603	178	19	4	7	3	12	1
12th	1 360	724	177	17	7	5	9	11	10

II. — *Third egg-laying competition at Burnley*, 1913-14.

The first yearly test conducted in the State of Victoria was at Dookie College in 1904-05 under the supervision of the Principal. This test was won by six White Leghorns, which laid 1313 eggs during the twelve months. In the next two yearly tests the winners were six Silver Wyandottes with 1296 eggs and six White Leghorns with 1314 eggs respectively.

If these figures be compared with those of the winning birds at the recent test at Burnley, the great improvement in the egg-producing qualities of White Leghorns will be seen.

In the 1913-14 test 63 pens of six birds each competed. Of these 54 contained White Leghorns, 5 Black Orpingtons, 2 Black Spanish

and 1 each Golden Wyandottes and Rose-combed Brown Leghorns. The winning pen of White Leghorns produced 1667 eggs during the twelve months, being an average of over 277 eggs from each bird. This pen also produced the greatest number of eggs during the four winter months, namely 533. The value of the eggs produced by the winning pen, at 1*s* 2*d* per dozen, was £8 2*s* 2*d*, which leaves a profit of £1 1*s* 4*d* from each bird over the cost of food. The twelve best groups produced an average of 251 eggs each for the year. The whole of the birds competing in the test averaged over 212 eggs each for the year, with a profit of 15*s* per bird over the cost of the food. In the heavy breeds the best pen of six Black Orpingtons laid 1216 eggs in the year.

Taking the average egg production, the White Leghorns are easily first, with an average of 216 eggs per bird. The averages for the other breeds were: Black Orpingtons 190, Black Spanish 189.7, Golden Wyandottes 172, and Rose-combed Brown Leghorns 169.

1035 — **Bee-keeping in Portorico.** — PHILLIPS, E. F. (Bureau of Entomology, U. S. Department of Agriculture) in *Portorico Agricultural Experiment Station Bulletin* No. 15, 24 pp. + 4 figs. Washington, 1914. BEES

The Portorico Agricultural Experiment Station at Mayaquez has been interested in bee-keeping since 1908. In 1913 the Station and the Portorico Board of Agriculture requested the writer to inspect the conditions of bee-keeping in the Island. The present Bulletin is the report of the above inspection, which was carried out in May and June 1913.

Before the American occupation, it may be said that bee-keeping did not exist at all in Portorico. There were, however, numerous swarms of wild bees (introduced perhaps at the time of the Spanish conquest), the honey of which was collected. In 1908 the Portorico Agricultural Experiment Station imported five swarms of Italian bees and began to give practical instruction in bee-keeping. This was the beginning of the industry in the Island. Bees multiplied wonderfully in Portorico, and now the five initial swarms have become several thousand.

Bee-keeping is practised especially in the western part of the Island and chiefly in the neighbourhood of Mayaquez, mostly on an industrial scale, as every bee-keeper has from two to three hundred hives and some upwards of five hundred. Italian bees are almost the only ones kept. Some have experimented Cyprus or Carniola breeds; it must, however, be mentioned that the former gave decidedly negative results in the United States and in consequence are not to be recommended. The Langstroth hive with ten-bar frames is generally used with one or two lifts for the storage of honey, separated from the brood combs by a queen excluder. The bees collect honey almost all the year round, hence the production of honey is very heavy. Productions of from three hundred to five hundred pounds of honey per hive are recorded. It may be stated that a good bee-keeper in average localities produces about three hundred pounds of centrifugated honey per annum. The honey is collected several times in the course of the year. Only centrifugated honey is made, and it is sold in barrels containing 50 American

gallons. According to the writer sufficient attention is not paid to the production of and trade in wax.

Foul brood (1) is unknown in Portorico, and in order to prevent its introduction it is forbidden by the law of September 3, 1913, to import into the Island hives or parts of hives, eggs, larvae, etc. Only queens may be imported, each with not more than 30 workers and enclosed in boxes. These are examined at the port of entry by the Board of Commissioners of Agriculture. But as foul brood is more likely to be imported with infected honey than with bees, a Bill has been presented with the object of forbidding the importation of honey which cannot be proved to come from healthy hives.

The exportation of honey from Portorico has risen during the last five years (1909-14) from practically nothing to about $100 000. The difficulty and the cost of transport still constitute the most serious obstacles to the development and spread of bee-keeping in the mountainous Island of Portorico.

As for the plants supplying nectar for the bees, the trees used to shade coffee plantations are excellent; for this reason bee-keepimg is chiefly practised where coffee is grown. The principal plants for bees are: *Inga laurina* ("guama"), *Inga vera* ("guava"), very good shade plants for coffee, in bloom almost all the year round; *Boystonea boringuena* ("palma real"); *Cocos nucifera*, abundant throughout the Island; *Spondis lutea* ("jobo"); *S. purpurea* ("cirvela"); *Andira jamaicensis* ("moca" or "cabbage tree); *Drypetes glauca* ("palo blanco" or "varital"); *Coffea arabica*, largely cultivated in the mountainous part of the interior of the Island, but as its flowers fall soon it has not the same value for bees as its shade plants; *Cupania americana* ("guara"); *Jambosa jambos* ("pomarosa", rose apple); *Mangifera indica* — the bees are also found of the over-ripe fruit of this tree which fall to the ground, but they do not injure the sound fruit; *Persea gratissima* (alligator pear); *Lantana* spp. ("lantana" or "cariaquillo"); *Borreria ocymoides* ("botoncillo"); *Musa* spp.; oranges, lemons and other citrus fruit, plentiful in the island, either wild or extensively grown; *Agave* spp.; *Pithecolobium* spp.; *Hymenaea baril* ("algaroba").

The following plants, which in other countries have been observed as supplying food to bees, are frequent in Portorico: *Avicennia nitida*; *Cassia* spp.; *Gossypium* spp.; *Hippomane mancinella*; *Melilotus* spp.; *Nicotiana tabacum*; *Erythrina* spp.; *Paritium tiliaceum* or *Hibiscus tiliaceus*, the fibre of which is used for making ropes; *Haemotoxylon campechianum*; *Saccharum officinarum*; *Acacia* spp. etc.

SILKWORMS

1036 – **Economical Methods of Rearing Silkworms.** — FORNACI, C., in *L'Italia Agricola*, Year 51, No. 9, pp. 401-404. Piacenza, September 15, 1914.

This new system of rearing silkworms aims at more hygienic conditions and a greater economy in leaves and labour. It enables the same number of worms to be reared as by the Lombard method, without requiring too great changes from the system in general use. It consists essential-

(1) See No. 1202, *B.* August 1912. (*Ed.*).

ly in the use of shallow trays with permeable bottoms, which allow air to pass and the excreta to fall, while the largest possible quantity of the leaves can be fed attached to the twigs.

From the time of hatching to the third moult, the worms are reared on trays made from reeds covered with paper and fed on loose leaves. The innovation is used after the third moult and consists of tiers of trays made from reeds bound together with spaces nearly half an inch between each reed. The alternate trays are covered with paper or cloth so as to catch the excreta from the one above. The bases of such trays can thus be replaced by movable frames of metal wirework, bare or covered with paper or cloth according to requirements. The trays are placed in pairs 8 to 12 in. apart and 20 to 24 in. between the pairs. Two days after the third moult mulberry shoots 16 to 20 in. long are given plentifully to the worms; when they have been defoliated they are moved, with the worms on them, to the open trays. During the period between the third moult and pupation some of the accumulated branches should be removed and the worms thinned out; at the time of pupating the space allowed should be about 15 sq. feet per gram of eggs.

A further saving of space may be obtained by placing a light cloth on sticks under each tray to catch the excreta; this need be only 4 to 6 in. below the tray.

The superiority of this system has been demonstrated in the experiments carried out by the travelling lecturer of Gallarate in 1914.

This year's results show:

1) a greater economy of space than with the Lombard system;

2) more hygienic conditions for the worms and very low mortality from "flacherie" and "jaunisse";

3) a saving of 4 to 6 cwt. of leaves per ounce of eggs;

4) a saving of ¼ to ⅓ of the labour required by the old system;

5) a minimum of expense in effecting the improvements;

6) a better quality of silk and heavier cocoons, going 30 less to the kilo than with the old ystem.

1037 – **Report on Sericultural Experiments in France during 1913.** — LAMBERT, M., in *Bulletin Mensuel de l'Office de Renseignements Agricoles*, Year 13, No. 5, pp. 593-595. Paris, May 1914.

On the 30th of July 1913, the French Parliament voted a sum of £2 000 for the encouragement of sericultural experiments. This was distributed as follows: £160 was granted to the Department of Science and Repression of Frauds and £1 840 to the Department of Instruction and Agricultural Organization.

The latter amount was utilised as follows.

1. Institution of local sericultural competitions . . . . . £ 1 440
2. Creation of experiment fields and nurseries for mulberries at the Schools of Montpellier, Antibes, Ecully, Oraison and Valabre . . . . . » 200
3. Distribution of young mulberry trees and silkworm eggs in batches of 5 gms. for each experiment, to private persons, schools of agriculture and primary schools . . . . . » 120

4. Installation of material at the Sericultural Station of the School at Montpellier for comparative experiments on silkworm rearing by different methods, and expenses of the organisation of competitions and experiments . . . . . £ 80

The local competitions were held in 36 cantons belonging to 18 departments. The number of silkworm rearers, farmers or silkworm egg-breeders taking part was 743. The members of the visiting commission were chosen, as for previous competitions, as far as possible amongst persons living in the particular departments concerned.

The carrying out of these dispositions was entrusted to an Interdepartmental Commission nominated by the Minister of Agriculture, which visited the 743 farms between October 1913 and January 1914. Of this number 585 were considered worthy of being recommended to the Minister for reward.

In the course of its visits the Commission made the following observations:

1) It is easily possible to determine with sufficient accuracy the quality of the products of the competitors at other times than the rearing periods and to classify them according to their merits.

2) The great majority of rearers hatch under defective conditions; worms are often reared in small unhealthy rooms, and the cultivation of the mulberries leaves much to be desired.

3) The rearers accept the advice offered by the Commission and are disposed to profit thereby.

With regard to the distribution of young mulberry trees, it has not been possible to give satisfaction to all requests. The number distributed has reached about 10 000.

FISH BREEDING

1038 – **Fish Breeding in Switzerland in 1913.** — *Schweizerische Fischerei Zeitung*. Year 22, No. 5, pp. 122-126. Pfäffikon, May 1914.

During the breeding season 1912-13, 191 fish-breeding establishments were in activity, as against 192 in the preceding year. The area occupied by the incubation nurseries was 6943 square feet and the number of brood glasses was 591. Out of 121 55[illegible] 550 eggs 97 422 880 fishes were hatched. Of this number, including 60 302 summer fish and one-year-olds, 97 150 882 (in 1911-12 81 050 630) were placed under State control in public waters.

The kinds of fish that were incubated are as follows:

	numbers
Salmon	1 292 400
Salmon hybrids	103 000
Lake trout	2 546 800
River and brook trout	7 373 030
Char	4 350 050
Grayling	2 227 500
White Fish (coregouns)	70 809 100
Pike	8 370 500
Perch	90 000
Eels	146 000
Foreign species	93 500
Brook char	21 000
	97 422 880

In order to defray the expenses of incubating and setting out the fry, the Confederation granted the Cantons the sum of £ 1385 (against £ 1300 in the preceding year) which was distributed among the owners of the various establishments.

In the above figures the work done in the Canton Valais is not included, as no data have been supplied.

The number of fishery inspectors in the service of the Cantons was, in the year reported upon, 170, to which at times are added 11 assistants; the salaries, daily and travelling expenses, amounted to £ 3981, against £ 3747 in 1912. The Confederation contributed one half of these sums. For the destruction of animals injurious to fish the Cantons spent £ 35 7*s* 6*d*, to which the Confederation contributed £ 16 11*s*.

In these figures on the inspection of fisheries, the Canton of Geneva is not included, as it did not ask for a grant or send in any report.

The Swiss Fishery Association received, as usual, a grant from the Confederation of £158.

The International Fishery Association for the Lake of Constance was granted by the Confederation, as well as by the other States bordering on the lake, a sum of £ 12 towards the expense sustained in 1913 for restocking the lake with fry.

On May 2, 1913, the Federal Council issued an Order concerning fishing in waters common to Italy and to Switzerland, as a supplement to the agreement of June 13, 1906, and which entered into force on June 1, 1913.

FARM ENGINEERING.

1039 – **Report of the International Competition of Motor Tillage Machines at Chaouat, Tunis, in 1914.** — *Direction Générale de l'Agriculture, du Commerce et de la Colonisation, Bulletin*, Year 18, No. 79, pp. 445-503. Tunis, July 1914.

AGRICULTURAL MACHINERY AND IMPLEMENTS

An international competition of motor tillage machines was organized by the General Direction of Agriculture of Tunis and held at Chaouat from the 15th to the 23rd of April 1914.

About 750 acres of stubble land were devoted to the trials of the various machines, twenty-four of which were entered, but, owing to various circumstances, only nineteen took part in the trials. Of these, nine were tractors, two portable engines with windlasses, four motor ploughs and four rotary tillage machines, including one hoeing machine.

The machines tried were the following :

Tractors. — America; Avery; Caterpillar; Case; Emerson (Big Four); Mogul; Ransomes; Rumely; Titan.

Portable engines with windlasses. — Two Franco-Hungarian portable gas engines.

Motor ploughs. — Moto-aratrice (Pavesi and Tolotti); D. K.; Stock; Akra.

Rotary tillage machines. — Charmes; Coupin; Motoculture française,

Hoeing machine. — Bauche.

Machine	Time employed in actual working		Area ploughed	Depth of furrow	Consumption of fuel and oil	Fuel per acre	Cost of fuel per acre (2)		Area ploughed in 10 hours
	hrs.	mins.	acres	inches			s	d	acres
Tractors:									
America (1) 40-50 HP. With six-furrow plough	2	3	2.47	7.87	8.58 gals benzine	3.47 gals	5	7.57	11.86
Avery 80 HP. With eight-furrow Cockshutt plough . .	2	31	4.94	»	10.62 gals benzine 0.44 lbs oil	2.15 gals	3	6.16	19.64
Big Four 55-60 HP. With six-furrow John Deere plough	3	11	6.03	»	0.92 gals benzine 23.69 gals Atlantic petrol 2.64 lbs. oil	0.15 gals benzine 3.94 gals petrol	3	1.38	18.94
Case 40 HP. With six-furrow plough, but only three shares working	4	5	3.46	»	13.11 gals Atlantic petrol 3.41 gals benzine 1.81 lb. oil	3.79 gals petrol 0.97 gals benzine	4	8.00	8.44
Caterpillar 60 HP. With eight-furrow Deere plough, only six shares working.	4	20	6.67	»	22.44 gals Atlantic petrol 2.40 gals benzine 4.95 lb. oil	3.36 gals petrol 0.36 gals benzine	3	3.85	15.39
Mogul 60 HP. With six shares in two independent frames.	4	32	7.14	»	33.5 gals Atlantic petrol 24.2 lbs oil	4.70 gals petrol	3	9.45	15.74
Ransomes 35-40 HP. With four-furrow Ransomes gang plough	5	7	5.41	»	17.59 gals Adriatic petrol 1.98 lbs oil	3.26 gals petrol	2	5.25	10.58
Rumely 30 HP. With four-furrow plough	4	8	4.72	»	22.13 gals Adriatic petrol 0.34 gals benzine 2.86 lbs. oil	4.65 gals petrol 0.34 gals benzine	3	6.16	11.42
Titan 45 HP. With plough with four independent shares	4	0	4.03	»	19.28 gals Adriatic petrol 11 lbs. oil	5.0 gals petrol	3	9.06	9.63
Portable engines with windlasses:									
Franco-Hungarian (16-20 HP) water-gas engines with Rud. Sack five-furrow plough	2	36	2.00	9.84	115.76 lbs charcoal 26.00 gals. water	57.88 lbs charcoal 13 gals water	1	5.48	7.71
do. do. wiht a one-share Bajac plough	2	37	0.56	19.29	117.97 lbs charcoal 31.17 gals water	210.67 lbs charcoal 53.66 gals water	5	3.73	1.97
Motor ploughs:									
Moto-aratrice 16-20 HP. (Pavesi and Tolotti) with three shares fixed in front	4	14	3.04	7.87	9.28 gals benzine 1.1 lb oil	3.04 gals benzine	4	1.197	7.16
D. K. motor plough, 80-105 HP with three shares . .	2	22	5.68	»	11.48 gals benzine 6.98 lbs oil	2.00 gals benzine	3	3.27	23.98
Stock, motor plough, 42-50 HP	2	36	6.52	»	11.33 gals benzine	1.74 gals benzine	2	10.07	24.70
Rotary tillage machines:									
Charmes, pulveriser, 26 HP	8	52	3.38	9.84	22.02 gals benzine	6.51 gals benzine	10	7.45	3.82
Meyenburg's motor cultivator, 30 HP	1	5	0.62	7.08	3.52 gals benzine	5.69 gals benzine	9	3.29	5.68
do do. second trial	4	41	1.85	7.87	13.64 gals benzine	8.01 gals benzine	13	1.88	3.95

(1) Owing to an accident the tractor America was not able to take part in the trials with the other machines, but was tried at the farm of the Colonial School of Agriculture.

(2) The cost of the fuel has been calculated: Benzine 1*s.* 7.46 *d* per gal., Atlantic petrol 9.73*d* per gal., Adriatic petrol 9.0 *d* per gal. and charcoal 2*s* 9. 87*d* per cwt.

The land was situated in the extensive plain of Chaouat. The soil was very homogeneous, compact and dry, so that the heaviest machines sank but little into it.

Most of the trials as to consumption of fuel were carried out on strips 3493 feet long by 98 wide.

The accompanying table (opposite) summarizes the results of the trials. Only the cost of the fuel used is given, as the total cost of the work depends upon several variable factors, the chief of which is the amortizement, which in its turn varies considerably with the amount of work done in the course of the year, the quality of the materials used, etc.

As already stated several dynamometer trials were also made, the results of which are given in the Report. The depth of work was regulated so as to require a fairly constant traction together with a maxium effect of the tractor, without diminishing too much the number of revolutions of the motor.

The average effort ranged from 1015 to 1624 lbs. per square foot. In a soil requiring an effort of 1421 lbs., a furrow about 8 inches deep by 12 wide demands a team of eight mules or 12 native oxen.

1040 – **The Reaper-Thresher.** — SHAW, J. W., in *The Agricultural Gazette of New South Wales*, Vol. XXV, Part 5, p. 376. Sydney, May 2, 1914.

The Reaper-Thresher, more commonly known as the "header", is a comparatively new machine and is becoming more popular from year to year.

One great difference between these machines and a harvester is that the heads instead of being stripped or combed off are cut off by a knife which is worked at the rear of the comb. The straw is drawn through the comb until the heads, assisted by the reel, come in contact with the knife. The fact of the heads being cut greatly lessens the draught. Should the ground be soft or the straw weak, the wheat is not pulled up by the roots and choked in the comb, nor is there any choking when the crop is dirty with thistles or other weeds.

When the heads are cut they are carried by means of the reel on to the canvas conveyors at the rear of the comb, which then carry them to the feeder of the threshing drum; this drum is very large and by means of pinions its speed may be varied to meet varying conditions. A second drum is placed at the rear of the machine to re-thresh any broken heads which may have escaped the first threshing.

The straw is thrown out at the side at the rear of the wheels. The grain is fed evenly on to the riddles, where it is winnowed, and is then carried by elevators into the grain box, which has a capacity of five bags.

The machine takes an eight-foot cut, and with two average teams of five horses each, in a fair crop, from 15 to 20 acres may be harvested in a day. There is very little waste of grain as compared with some other harvesters, and the lightness of draught and its power to deal with a weedy crop make the header a most valuable addition to the wheat grower's plant.

1041 – **Straw Press Binder with Two Pincer-like Groups of Arms working together.** — *Maschinen Zeitung*, Year 12, No. 8, pp. 92-93. Berlin, April 15, 1914.

A new straw press for tying straw into bundles as it issues from the threshing machine has been devised by Messrs. Volkenborn of Langenberg, and patented in Germany under No. 270 841.

It consists of two pincer-like groups of arms, which are moved towards each other by the action of one hand lever.

The press is shown open in fig. 1, half closed in fig. 2, and closed in fig. 3.

It consists of a frame a_1 a_2 and a cross piece *b*, on which the arms *c* and *d* are fixed to the pivots *f* and *g*. The arm *d* is connected by the bar *h*, hinged in *i* to the hand-lever *m*, the fulcrum of which is in *k* on the cross-piece *b*.

The other press arm *c* is worked by the bar *o*, which rests on the bolt *p* and is joined to the hand-lever *m* in *n*. This bar carries a roller *q* which runs along the bottom of the lower branch *r* of the arm *c*.

The lever is so arranged that the pressure increases towards the end of the operation and that when the press is in its closed position (fig. 3) the lever is pressed against the bolt *s* and kept there.

Thus, by a simple movement of the lever *m*, not requiring any great exertion, the straw is pressed and kept so until tied.

In order to prevent fresh straw from the threshing machine sliding down the inclined plane *y* onto the binder, the arm *c* carries a kneed piece *t* which raises the straw fender *x* and keeps it there till the press is again opened.

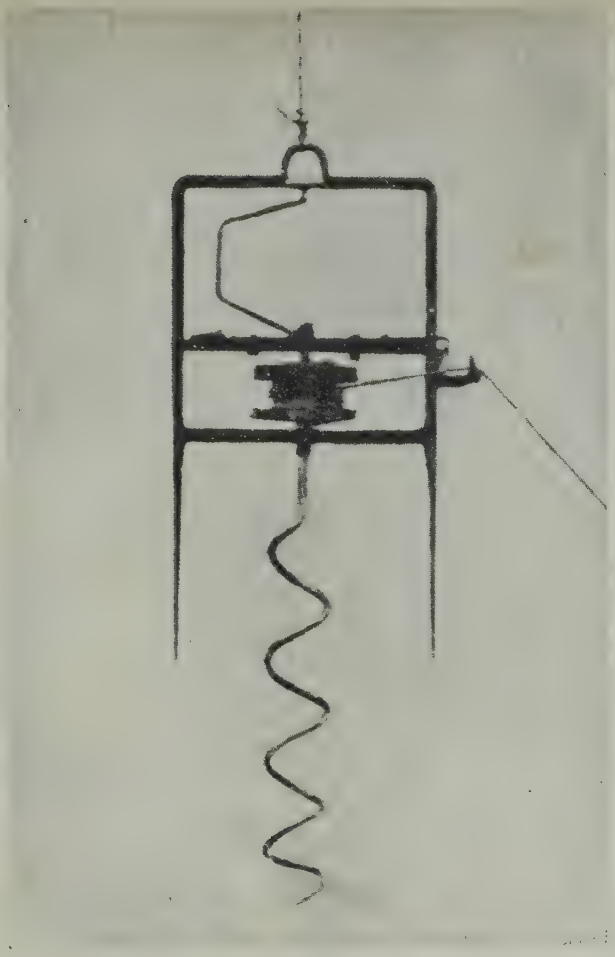
1042 – **Swift's New Hay Elevator Fork.** — *The Implement and Machinery Review*, Vol. 40, No. 473, p. 682. London, September 1, 1914.

The accompanying illustration shows the new hay fork elevator for the building of haystacks, devised by Mr. A. J. Swift of Eccleston, Lancashire. The spiral stem and the two side spikes are, by four or five turns of the crank in the upper part of the fork, pressed down into the hay, and grip a load. When the load is elevated to the desired height the operator simply pulls a rope gently, causing the spiral to unwind, when the hay falls off into several different places on the stack instead of being dumped in one heap.

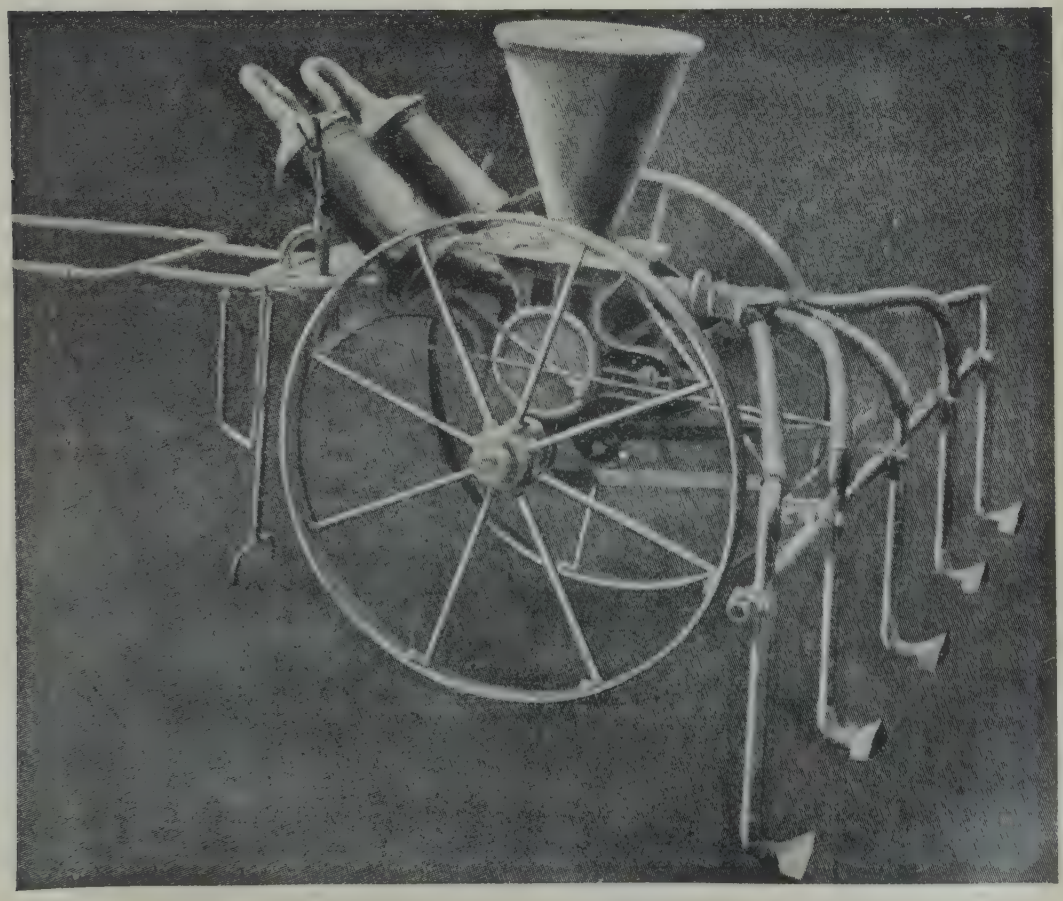
1043 – **Machine for Pickling Seed Wheat.** — ARVAY, ERNST, in *Wiener Landwirtschaftliche Zeitung*, Year 64, No. 15-4916, p. 135. Vienna, March 14, 1914.

It often happens in practice that smut appears on the crop notwithstanding the pickling given to the seed. This is due to the careless way in which the pickling is usually conducted, and which often consists in rapidly dipping baskets containing the seed into fungicide solutions. Besides being unreliable, this process is also costly as it requires much labour.

In order to avoid these drawbacks the writer devised and constructed a pickling machine which consists of a trough made of pure copper, to contain a solution of copper sulphate, in which a horizontal drum pierced



Swift's Hay Elevator Fork.



Randell's Dry Sprayer.

Fig. 1

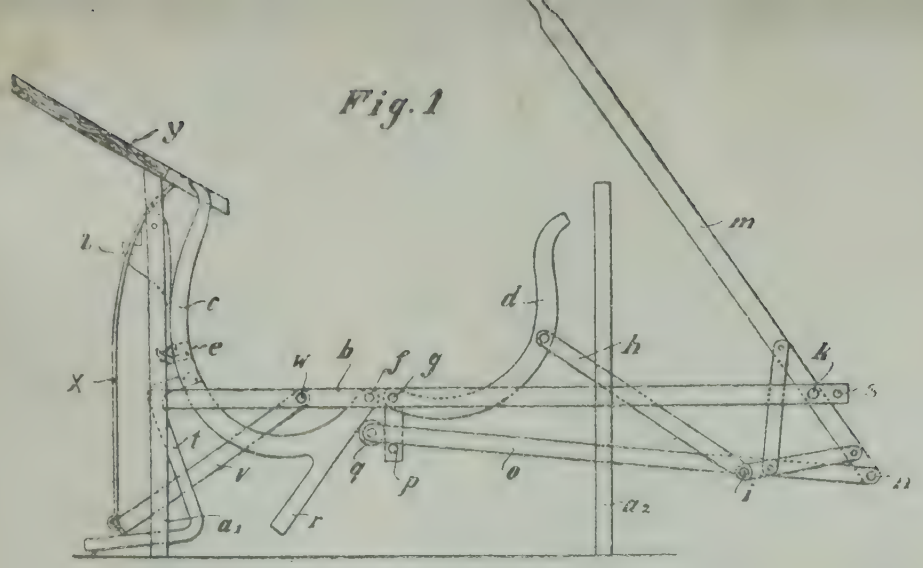


Fig. 2

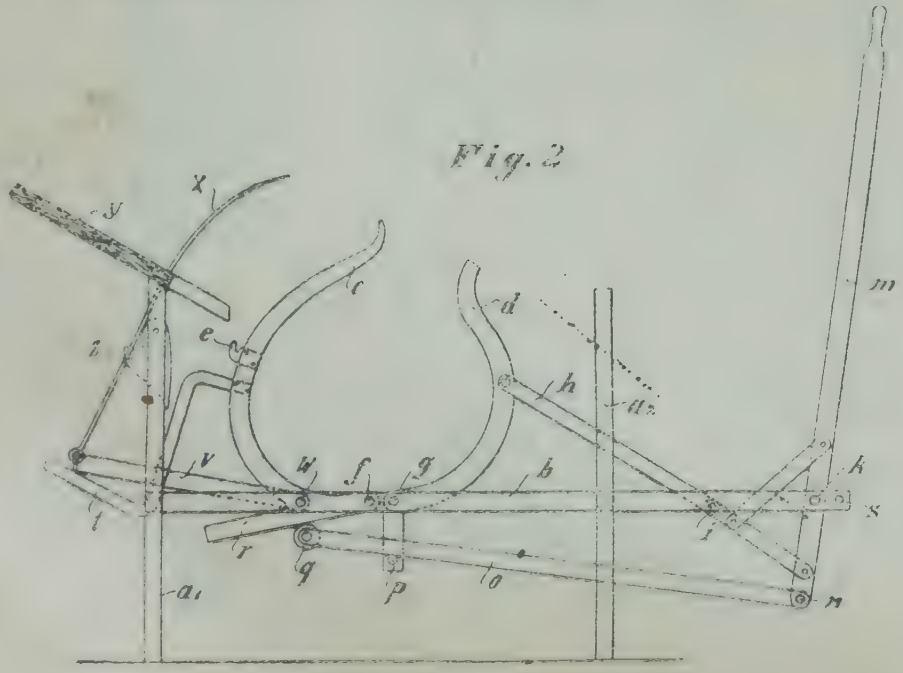
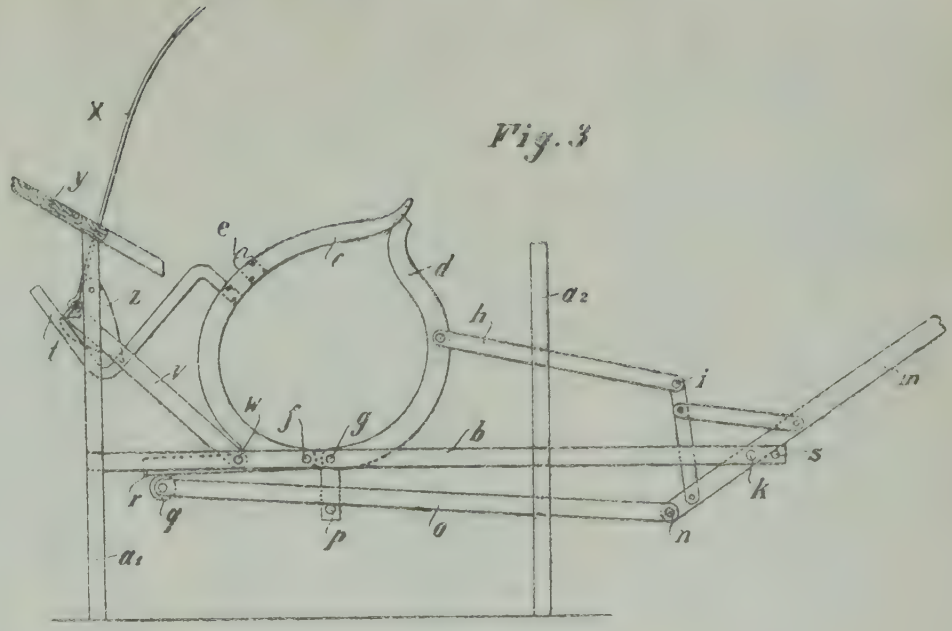


Fig. 3



STRAW PRESS BINDER.

Fig. 1. — Open.
Fig. 2. — Half closed.
Fig. 3. — Closed.

with minute holes revolves. The seed is poured into a hopper, the outlet of which can be closed by a slide, whence it falls into a channel leading into the drum. In this an endless screw pushes the wheat along slowly so that it stays from three to five minutes in the solution, every grain being wetted by it. At the other end of the drum another screw ejects the pickled grain.

With this simple machine a saving of about three-quarters of the labour required by the primitive method is effected and the work is done thoroughly.

1044 – **Randell's Dry Sprayer.** — *The Implement and Machinery Review*, Vol. 40, No. 472, p. 559. London, August 1, 1914.

Among the machines exhibited at the Royal Agricultural Society's Show at Shrewsbury in July of this year there were two entirely new machines for dry spraying built by Messrs. F. Randall and called the " Simply Perfect ". One was fitted with five nozzles, as in the accompanying illustrations, for spraying as many rows of potatoes, for large farms, the other with two nozzles for small holdings. The blast is not produced by a fan but by two cylinders and pistons, which run at much less speed, giving a continuous blast and requiring less power to drive, a small pony being sufficient.

An agitator is provided and the feed is so arranged that any quantity of powder can be sprayed. Roller bearings are used throughout. The price of the larger machine is £30 and of the smaller one £15.

1045 – **Wallace's Portable Milking Machine.** — *The Implement and Machinery Review*. Vol. 40, No. 473, p. 672. London, September 1914.

Now that the importance of the purity of milk is universally recognized, out of door milking is advocated as a means of ensuring greater cleanliness than indoor work. In order to facilitate milking in the open, Messrs J. and R. Wallace of Castle Douglas, Scotland, have devised a portable milking machine. This plant consists of a portable house and a portable wooden framework to which the cows can be tied. The house contains a 3 ½ HP. Capelpetrol-paraffin engine connected to a vacuum pump and a vacuum storage tank. An iron pipe is fixed along the portable frame just above the cows' heads and this is connected to the vacuum tank and pump by a flexible steel tube. The framework provides accommodation to twelve cows, the animals being held during milking by a sliding bar which grips them behind the head. Six cows are milked at once and directly one is finished another takes its place. Each day the plant is moved to a different part of the field so that the cows always stand on clean grass.

1046 – **Review of Patents.**

Tillage machines and implements.

Austria
66 708. Skid for wheels to facilitate the turning of tillage machines.

Canada
154 074. Rotary plough.
154 093. Stone-picking machine.
154 270. Plough.

nada	154 304. Plough fender.
	154 308. Weeder.
	154 334 and 154 352. Ploughs.
	154 374. Harrow.
	154 476. Plough mechanism.
	154 552. Plough.
	154 781. Machine for hoeing potatoes.
enmark	19 032. Motor plough.
	19 118. Shares for rotary plough.
	19 124. Motor plough.
rance	469 985. Hoeing machine with balanced rotating axles.
ermany	274 831. Cleated tyres for the driving wheels of agricultural machines, especially motor ploughs.
	274 936. Mould board built in two parts, especially for reversible ploughs with two shares situated back to back.
	274 958. Tillage machine with revolving drums bearing hoes.
aly	137 728. " Campione " motor plough.
	141 652. " Ronco " plough.
nited Kingdom	7 118. Cultivators.
	8 595. Trench excavator.
	9 880. Steering gear for motor ploughs.
	9 992. Side share for ploughs.
	10 276. Digging machine.
nited States	1 103 450. Combined clod cutter and crusher.
	1 103 284. Harrow.
	1 103 293. Subsoiler plough attachment.
	1 103 543. Plough adjusting mechanism.
	1 103 595. Cultivator blade.
	1 103 929. Land roller.
	1 104 027 ; 1 104 293 ; 1 104 329. 1 104 636. Cultivators.
	1 104 187. Plough lift for gang ploughs.
	1 104 569. Plough.
	1 104 748. Disk harrow.
	1 105 032. Reversible plough.
	1 105 198. Cultivator.
	1 105 450. Three-row wheel corn cultivator.
	1 106 119. Gang plough.
	1 106 213. Orchard plough.
	1 106 312. Subsoil attachment.
	1 106 190. Machine for gathering stones.

Manure distributors.

Jnited Kingdom	7 121 and 7 663. Manure distributors.
Jnited States	1 104 247. Agitator and feeder for fertilizer distributor.

Drills and sowing machines.

Canada	154 156. Corn planter.
Germany	274 832. Combined potato laying machine and manure distributor.
Jnited Kingdom	7 345. Drills.
	7 912. Machine for making holes for planting potatoes.
	9 931. Potato planters.

United States
1 103 299, 1 104 214. Corn planters.
1 103 593. Marker for corn planter.
1 103 831. Seed planter.
1 104 602. Attachment for grain drills.
1 104 725. Potato planter.
1 105 075. Seeder.
1 105 665. Corn planter.

Reapers, mowers, etc.

Austria
66 663. Fastening for the tines of tedders, rakes and the like.

Canada
154 078. Sheaf loader.
154 132. Harvester.
154 160. Grain rake.
154 166. Hay gatherer and loader.
154 339. Sharpener for lawn mowers.
154 356. Hay press.
154 361. Harvester mechanism.
154 464; 154 472. Railway mowers.

Denmark
19 113. Device for binders.

Germany
274 699. Apparatus for conveying the reaped cereals to the binding mechanism in binders.
274 748. Process and apparatus for drying clover.

United Kingdom
6 578. Track clearer for mowing machines.
7 215. Lawn mowers.
9 443. Reaping and mowing machines.

United States
1 103 766. Corn harvesting machine.
1 104 020. Tooth for hay rakes.
1 104 213. Header device.
1 104 240. Binder sickle guard or tooth.
1 105 235. Harvester.
1 105 445. Pea harvester.
1 105 751. Mowing machine.
1 106 018. Harvesting machine.

Machines for lifting root crops.

Austria
67 010. Beet topping machine.

Canada
154 098. Potato separator.
154 180. Potato digger.

Denmark
19 082. Potato lifter.
19 094. Beet topping apparatus.

Germany
274 623. Machine for collecting and sorting potatoes.

United Kingdom
7 084. Potato harvester.

United States
1 103 321. Potato digger.
1 105 327. Potato sorting apparatus.
1 105 427. Potato sorter.
1 105 728. Beet harvester.

Threshing and winnowing machines.

Austria
66 664. Automatic feeder for threshing machines with apparatus for cutting the sheaf tie.

Germany
274 667. Automatic feeder for threshing machines.
274 937. Grading apparatus with fan and several screens with return planes between them.

Italy	142 523.	Improvements in straw elevators.
United Kingdom	7 971.	Improvements in threshing machines.
United States	1 103 324.	Threshing machines for standing grain.
	1 104 033.	Attachment for threshing machine feeders.
	1 104 677.	Corn sheller.

Other agricultural machines.

Austria	66 347.	Apparatus for tying up live stock in stables.
	66 352.	Milking machine.
	66 357.	Centrifugator for frothy liquids.
	66 450.	Milking machine.
	66 655.	Drinking trough.
	66 666.	Portable circular saw for cutting sugar cane.
	66 674.	Device for untying live stock.
Canada	154 102.	Wheel jack and belt-tightener.
	154 116.	Rossing machine.
	154 139.	Milking machine.
	154 198.	Cherry stemming machine.
	154 204.	Bean sorting belt.
	154 221.	Fruit picker.
	154 315.	Grain tester and seed separator.
	154 434.	Yeast tester.
	154 499.	Tree scraper.
	154 632.	Milking machine.
	154 675.	Fruit grading machine.
	154 786.	Grain cleaning mill.
	154 797.	Incubator.
	154 838.	Churn.
	154 843.	Tree sprayer.
Denmark	19 033.	Device for forks and similar implements.
	19 035.	Milking machine.
	19 178.	Straw baler.
Germany	274 498.	Steering swivel for agricultural machines.
	274 499.	Cleaning apparatus especially for cereals.
	274 501.	Hand stump-pulling machine.
	274 557.	Portable sprinkling apparatus.
	274 624.	Device in balers for passing the wire led on both sides of the bales.
	274 666.	Apparatus for working agricultural motors by electric power.
	274 700.	Straw press.
	274 702.	Milk strainer with several filters situated over each other and kept in position by tension rings.
	274 889.	Machine for raising clay from moor soils.
	274 938.	Machine for slicing beets, potatoes and the like.
Italy	140 473.	Hay baler.
	142 047.	Automatic watering mechanism.
	142 145.	Semi-automatic system of threading the needle for binding the bales in fodder balers.
	142 162.	Apparatus for untying animals in stables.
	142 282.	Spraying pump with automatic agitator.
	142 289.	Apparatus for killing moles.
	142 381.	Continuous action machine for crushing and pressing grapes and removing the stalks.

United Kingdom
6 458. Brooder.
6 583. Machine for husking and cracking cohune nuts.
6 729. Germinating boxes.
7 568. Hedge trimmer.
7 612. Apparatus for extracting fruit juices by steam.
7 666. Weed puller.
7 671. Retting apparatus.
8 448. Spraying machine.
8 473. Baling press.
8 544. Apparatus for reducing wheat by successive grinding by rollers.
9 352. Apparatus for preparing food for animals from peat.
9 489. Apparatus for drying grain.
9 554. Baling press.
9 776. Hay loader and collector.
9 968. Rubber extractor.
10 012. Portable root cutter.
10 037. Traction engine.

United States
1 103 287. Hay fork.
1 103 326. Fodder loading apparatus.
1 103 492. Hay stacker.
1 103 678 ; 1 104 277 ; 1 105 551 and 1 105 562. Tractors.
1 103 733. Stacker.
1 104 312. Hauling device for agricultural machines.
1 104 431. Fruit gatherer.
1 104 537 and 1 106 046. Traction engines.
1 104 847 ; 1 104 934. Traction wheels.
1 104 885. Stacker.
1 104 962. Pump.
1 105 007. Hay press.
1 105 086. Steering gear for traction engine.
1 105 686 ; 1 105 862. Tractors.
1 105 916. Hay and grain loader.
1 106 202. Milking machine.
1 106 251. Baling press.

RURAL ECONOMICS.

1047 – **The Influence of Machines and Implements upon the Profitableness of Farms of Different Sizes.** — *Deutsche Landwirtschaftliche Presse*, Year XXXXI, No. 10, pp. 740-742 ; and No. 61, pp. 749-750. Berlin, July 29 and August 1, 1914.

The present paper is a résumé of the discussions and considerations contained in the recent work of Dr. Lichtenberger on the influence of agricultural machinery on the organization and profitableness of farms of different sizes, and which may be summarized as follows :

1. In farms grouped according to size, the relative profitableness of one class as compared with that of other classes is the result of a number of factors among which are included the use of machines and implements together with other economic and natural conditions.

2. Agricultural machinery has proved useful in increasing the profits of farms of all classes of sizes provided natural and economic conditions allowed machines to be used.

3. When farms of different classes of sizes compete with each other under equal conditions, the farm in which natural and economic conditions allow the greatest intensity of farming, will draw the greatest profit from the use of machinery.

4. As a rule, large farms are in the most favourable condition to make profitable use of machines and implements. The relative profitableness of such farms is influenced in the highest degree by the use of machinery.

Medium-sized farms occupy in all respects the most difficult position : they require machines just as much as the others but must pay a higher price for their work. Nevertheless these farms also, especially of late, find their profitableness increased by the use of machinery.

In small farms the number of implements and machines that can be profitably employed is limited. This fact, however, does not place small farms in a condition of inferiority to medium and large farms, as the former have no absolute need of machines and implements. On the other hand implements and machines, in so far as they are applicable in the small farm, are of decided assistance in increasing its capacity of competition and its relative profitableness. For this class of farms cooperation in the use of machines is most beneficial.

5. Without entering into the question of comparing absolute conditions, but only examining how far the recent development of machines and implements has altered the relative profitableness of the different classes of farms, it will be found that the use of machinery at first gave large farms a great advantage over the smaller ones ; this advantage in respect of medium-sized farms has gradually diminished in consequence of the recent development of machinery and of the steadily increasing intensity of farming. This process has especially been accelerated by the progress of electrical appliances. It is electricity that provides medium and especially small farms with the most suitable motive power. To a great extent also the so-called universal machines (namely those that by means of various attachments can be altered so as to perform different kinds of work) assist in spreading the use ofmachines to the smallest farms.

6. For the calculation of the cost of the work of machines Dr. Lichtenberger considers the figures proposed by Fischer and Lang for amortization and repairs as the most suitable and those which best meet the conditions of small farms. According to them the rate consists of a fixed portion of 8 per cent. per annum of the purchase price and a variable one per day. The former represents interest at 4 per cent. and 4 per cent. for amortization. The variable portion is determined in each case by the kind of machine and the number of days in the course of the year in which the machine is used, and varies, according to Fischer, between 0.09 and 0.5 per cent. per day's work. Through the lesser use of machines in small farms a compensation within certain limits is obtained between

large and small farms ; otherwise on account of the greater purchase cost per unit of performance the amortization and repairs would be absolutely a larger item in small farms than in larger ones. The cost of teamwork should also be reckoned at lower rates in small and medium farms. If, further, the cooperative use of machines and the use of universal machines be considered, the conclusion can be drawn that the cost of machine work limits only to a very moderate degree the relative profitableness of small and medium farms.

1048 – **The Agricultural Labourers Required on Farms under 100 Hectares (247 Acres) in Extent.** — GERLACH, OTTO, in *Archiv für exakte Wirtschaftsforschung*, 15th Complementary Part, pp. 1-13. Jena, 1914.

The Chamber of Agriculture for the Province of East Prussia organized an enquiry in 1901 and 1902 on the conditions of agricultural labour; this was extended also to peasant farms. The writer discusses the results of this enquiry on the amount of labour required, and on the way in which this want was met, in 4600 farms occupying a total area of 197 600 acres. These results are collected in the following table :

Size of farm in acres	Average requirement of				Want of permanent labourers' families	Labour of owner and of his wife	
	Permanent labourers		Temporary labourers				
	Number	Days' work	Number	Days' work			
18 to 25	1	300	1	17-20	—	Both work always in all the farms	
37	2-3	600-900	1-2	40	not yet felt	» » »	
74 to 87	5	1300-1500	2-3	54-60	already felt (in 54 out of 138 farms)	Both generally work	
123	7-9	1550-2500	3	110-115	almost everywhere	The owner works only temporarily.	The owner's wife works only in the household
185	8-10	1600-2900	2-5	110-115	is common	The owner works only temporarily and seldom	» » »

The usual limit of the size of farms worked by the owner and his wife alone is from 12 to 15 acres. In the above table the data refer to the amount of labour required beyond that of the owner and his wife.

The influence of the distance from the village to the market or to the nearest railway station on the want of labour, could not be determined. A greater influence seems to be exerted by the state of the field roads and the extent of pastures.

On the supply of labour in 1288 farms of all classes of sizes between 10 and 250 acres covering an area of 108 700 acres the following figures afford information :

	On the 1288 farms		
	were required	were available	were wanting
Members of the family	1 464	1 464	0
Permanently occupied labourers' families	870	668	202
Farm servants	3 178	2 193	985

The number of permanent adult labourers required was 5512; of this number:

26.6 per cent. was supplied by members of the owner's family.
36.4 per cent. by farm servants.
16.2 per cent. by married helps.
20.8 per cent. was wanting.

The lack of permanent labour is greatest on farms between 50 and 70 acres in extent, being 29 per cent.; it is 28 per cent. on farms between 35 and 50 acres; it ranges from 18 to 22 per cent. on large peasant farms, while on smaller ones it is much less (16 and 12.5 per cent.) and it disappears altogether in the smallest farms. The unfavourable position in this respect of farms between 35 and 70 acres is explained by the fact that the collaboration of the members of the owners' families diminishes considerably, while they are unprovided with housing for labourers' families and consequently have to put up with unmarried farm hands, who are the most difficult to get.

1049 – **Influence of Economic Conditions on the Methods of Farming.** — AEREBOE, FRIEDERICH. Special reprint from *Jahrbuch der Deutschen Landwirtschafts-Gesellschaft.* Berlin, 1914.

The total process of development of public economy reacts upon agriculture chiefly by the difference between the prices of production on one hand, and the prices of the means of production on the other, and then also by the reciprocal relations of the prices of the individual agricultural products and of the several agricultural means of production. In a low stage of development of agriculture the prices of agricultural produce are low considered absolutely, and especially so in comparison with wages and with the prices of the purchasable means of production. Consequently the aim of the farmer must consist in cultivating large areas of soil with the employment of small quantities of labour and capital so as to ensure for these two factors a large harvest to compensate for its low price. At a higher stage of development, with higher prices for agricultural produce and comparatively low prices for the means of production, it becomes advantageous to increase the employment of labour and of live and dead stock per unit of area, so long as a surplus of production can be obtained.

Between these two extremes there are, however, innumerable stages which are characterized in the whole public economy by a progressive saving of the soil following upon its heightened utilization. In agriculture this sav-

ing of the soil and increased utilization is attained by the successive prefe rence given to such forms of utilization of the soil as require, it is true, greater outlay on labour and live and dead stock, but which yield a muc larger quantity of produce per unit of area, and also by concentrating th crops on the old cultivated areas and extending the utilization of the so to always poorer areas or such as are always more difficult to improve.

This evolution is naturlly accompanied by the creation of always nev systems of farming which differ from each other especially in the followin characters:

1. In the ratio between the different types of cultivation, especially in the ratio between woods and pastures on the one hand, and arable land on the other.

2. In the proportion of fallow to arable land.

3. In the proportions of the various crops, especially of hoed crops.

4. In the kind and extent of the crop grown for green manuring and especially in the proportion of catch crops.

The evolution of the systems of farming and the degree of its intensity thus depend chiefly upon the variations of the above conditions. With the general organization of the farm the importance and extent of the individual crops and cultural methods vary also and with them the tillage of the soil, the manures applied, the kind and quantity of seed, the harvesting, etc.

The writer considers the different degrees of development of a number of cultural methods in general and of their application to several plants. He distinguishes also as regards manuring the following regions of intensity or degrees of intensity in the use of farmyard manure, artificials and green manures, starting from the lowest or most unfavourable economic condition:

A. *Regions where farmyard manure and artificials are used:*

1. Regions in which the plant food diminishes.
2. Regions in which it is replaced.
3. Regions in which it is increased.

or

1. Regions that are not manured.
2. Regions in which only farmyard manure is used.
3. Regions in which farmyard manure and artificials are used
   - *a*) artificials chiefly containing nitrogen;
   - *b*) artificials chiefly containing phosphates;
   - *c*) artificials chiefly containing potash.

B. *Regions in which green manuring is practised:*

1. Regions without green manures.
2. Regions in which green manures are the chief crop.
3. Regions in which plants for green manures are sown among cereals.
4. Regions with plants for green manures sown among cereals or after harvest.

With the increasing prosperity of economic conditions the intensity of manuring increases also, with regard to outlay of both labour and capital. The same holds good, especially in the amount of labour, in the regions where weeds are controlled, of which the writer distinguishes ten :

1. Destruction of weeds only by changing arable land into pasture.
2. Do. by fallowing and ploughing between the principal crops.
3. Do. by surface ploughing, cultivating, harrowing, etc., but always by means of team work between the harvest and the preparation of the soil for the chief crops.
4. Do. by horse hoeing during the growth of the crops. Hand hoeing only in gardens.
5. Hand hoeing in field hoed crops.
6. Hand hoeing of wheat; possible through extension of hoed crops.
7. Hand hoeing of oats also, thanks to the still greater extension of hoed crops.
8. Hand hoeing of barley also.
9. Cultivation of rye in spring with Zehetmayr's roller harrow.
10. Destruction of weeds and plant diseases by means of different sprays.

From the above it will be clearly seen that all means of controlling weeds which entail labour are avoided in the lower stages of development, while in the higher ones those which demand extent of soil are abandoned.

The whole change in the development of the measures for the destruction of weeds consists in expending labour in order to save soil, which is also effected by concentrating the crops.

In the culture of rye three different regions are distinguished according to the density of sowing, as the quantity of seed diminishes inversely with the intensity of farming.

In the division of the regions of beet growing, the writer considers most of all their position in the rotation while with mangolds he gives greater importance to the methods of culture.

A. *Regions in which beets are grown.*

1. Beets only in small inner rotation, which through the frequent cultivation of hoed crops are kept fairly free from weeds.
2. Beets in the main rotation and for several successive years, in order to facilitate the destruction of weeds at least in the second and third years.
3. Beets in the main rotation in regular alternation with cereals.

B. *Regions in which mangolds are grown :*

1. Only seedlings planted out immediately after ploughing.
2. Only seedlings planted in levelled and half loosened soil.
3. Partly seedlings and partly sown mangolds.
4. Only sown mangolds.

This table also shows that the object of the farmer must be to get most returns from the outlay on labour in the lower stages, and in the higher ones greater returns from the soil area. The same conclusion may be drawn also from the succession of the potato regions:

1. Planting the potatoes after ploughing, earthing them up after repeated harrowing. Deep sowing is indispensable.

2. Planting potatoes in well loosened soil, alternately earthing up and carefully harrowing; sowing not so deep.

3. Alternate earthing up and hoeing with a horse-hoe lengthwise between the rows.

4. As No. 3, but hoeing crosswise.

5. No harrowing. The destruction of weeds effected only by hoes and chain harrow; in some cases a second hoeing by hand. Superficial sowing.

In this way areas of cultivation for all the other cultivated plants according to the methods of more extensive or more intensive cultivation and corresponding to the more or less advanced stage of economic conditions might be outlined. It is easy to understand that in different stages of development different demands are made upon cultivated plants and that consequently the aims of plant breeding must be different according as the plants are bred for localities of extensive or intensive farming. In order to illustrate this the writer draws up a table in which he compares the two extremes of wheat breeding, namely for extensively and for intensively farmed localities.

A. In the lower stages of farming or in localities situated in unfavourable economic situations, the returns per unit of area are secondary considerations, while the returns obtained by labour and capital are the principal ones; consequently the aims of breeding are:

1. Slight demands as to labour.

2. Slight need of manures.

3. High power of competing with weeds and the like.

4. Easy harvesting by machinery even should the quality of the product suffer.

5. Quantity and quality of straw secondary considerations.

B. In a higher stage of farming or for localities in economically favourable situation, the yields per unit of area are the chief considerations, while the yield per day's labour and per unit of capital are secondary matters; consequently the aims of breeding are:

1. High capacity of utilizing the labour spent upon it by high yields per unit area.

2. High capacity for absorbing fertilizers, even if accompanied by loss of thriftiness.

3. The increased care of the plants allows of their possessing a lower degree of resistance to weeds and the like.

4. High quality of the harvested grain, even if it should entail a greater consumption of labour.

5. High selling value of the straw and large quantities of it, increasing considerably the money value of the harvest.

According as these objects are more or less completely attained by breeding, the importance and the position of the individual cultivated plants change in the course of development. Those plants which by a great increase of harvest best repay the intense care and manuring bestowed

upon them will acquire most importance. In this connection the writer compares rye and oats. With oats the work of improvement was begun in Germany earlier than with rye and has obtained superior results. Consequently for many years oats have been given an always better position in rotations. From the lowest position it occupied in rotation, it has risen now to the second place, and where hoed crops cannot follow a green manure crop, oats occupy the first place. Only the later brilliant successes of rye breeding have retarded this development, but recently it has received a new impulse from the selection of Lochow's Yellow oats, which possesses all the desired qualities in a measure which had never been attained before.

1050 – **The Influence of the Prices of Agricultural Produce upon the Farming Conditions in Switzerland.** — LAUR, E. Reprint from *Schweizerischen landwirtschaftlichen Zeitschrift*, Year 1914, Nos. 26, 27, 28.

Swiss agriculture realized in the period from 1906 to 1913 about 22 per cent. more than in the period between 1901 and 1905 for the same amount of yearly production. In the same time the prices of farms, and especially of separate pieces of land, have increased considerably. That this rise in the prices of land does not always signify an increase of the value of the bare soil is proved by the following figures which show the changes in the values of farms and of the bare soil per acre of cultivable land between the period 1901-05, and that from 1906 to 1912, according to the book-keeping results obtained by the Swiss Peasants Secretariat.

Results of all the yearly balances from the investigations into profitableness.

Per acre of cultivable area	1901-05			1906-12			Increase			
Capital in:	£	*s*	*d*	£	*s*	*d*	£	*s*	*d*	per cent.
Farm	70	11	11	72	10	5	1	18	6	2.80
Soil	37	4	1	37	10	11		6	5	0.86
Buildings, improvements and plantations	33	7	5	34	19	6	1	12	1	4.80

If in the corresponding years only the farms that in those years began to have their accounts audited are considered, the results are as follows:

Per acre of cultivable area	1901-05			1906-12			+ Increase — Decrease			
Capital in:	£	*s*	*d*	£	*s*	*d*	£	*s*	*d*	per cent.
Farm	72	15	3	77	4	1	+ 4	8	11	+ 6.10
Soil	39	19	0	39	7	6	—	11	7	— 1.45
Buildings, etc.	32	16	3	37	16	8	+ 5	0	5	+ 15.30

From the above figures it appears that on average of all the farms examined the capital in soil per acre has remained very nearly the same and that the increased price of farms is mostly due to the greater value of buildings, improvements and plantations.

The greater receipts from farming are used in the first place to cover the growing cost of production. According to the observations of the Swiss Peasants' Secretariat, the cost of production of crops, not including the interest on capital amounted:

in the period 1901-05 to	£7 4*s* 5*d*	per acre
» » 1906-12 »	£8 8*s* 6*d*	»
thus increasing by	£1 4*s* 1*d*	or 17 per cent.

In the year 1912 the cost of production reached £9 4*s* 2*d*, or a third more than in the perlod 1901-05.

The share in the cost of production due to the interest on the capital in soil is mostly much overvalued. Thus, for instance, the average cost of production of milk in Switzerland during recent years was about 7.98*d* per gallon; of this less than 0.86*d* is due to the interest on the land, and from 1.29 to 1.73*d* to the interest of the other capital invested in farming. An increase in the cost of production caused by the interest on the soil cannot be recognized from the results of the examination of the accounts kept.

On the other hand the outlay on interest, amortization and repairs of buildings has increased, and amounts now to 10.8*d*. The greater demands of labour have much increased the cost of production. Labour alone claims 3.24*d* per gallon of milk. Wages have increased by 22 per cent., while, thanks to the use of labour-saving appliances, the average amount of labour per acre is only 13 per cent. more than formerly. Further, the higher prices of concentrated foods and artificial manures, the greater consumption of which have favoured the greater intensity of farming, have contributed to raise the cost of production. Only through higher prices is it possible for farming to stand this increase in the cost of production.

Under the influence of better-prices for his produce, the farmer has been able to attain better living. In farms which did not employ outside labour the cost of living per man-day in 1901-05 was 11.12*d* and in 1906-12 12.5*d*, or an increase of 1.38*d* or 12 per cent.

In the year 1912 it amounted to 13.25*d*.

In farms employing outside labour the cost of living has increased to a greater extent, being 14.25*d*. But as in this period the cost of articles of food has also risen, the nourishment has problably not changed much. On the other hand the other items of personal expenses have considerably improved per man unit and year. They amounted to £6 14*s* 10*d* in the period 1901-05, to £8 12*s* 1*d* between 1906 and 1912, increasing by £1 17*s* 3*d* or 27.7 per cent. In 1912 they reached £9 18*s* 3*d*.

Lastly, the higher incomes have allowed farmers to save more. On an average the savings per farm were £44 3*s* 4*d* between 1901 and 1905 £64 10*s* 11*d* between 1906 and 1911, an increase of £20 7*s* 7*d* or 46.1 per cent. and in 1912 they reached £80 1*s* 9*d*.

Only a very small part of these savings was invested in new capital proper, a certain amount was used for the paying off of debts, but more especially they were devoted to new installations in the farms, to the building of new outhouses, to the purchase of new machines and implements, to the increase of the live stock.

From the above it will be seen that the increased incomes of farmers, due to the higher prices of produce, benefited to a great extent other trades also, and that on the other hand a fall in the prices of produce with the usual cost of production would spell ruin to the farmers. If the whole debt of the agriculture of Switzerland, which amounts to about £150 000 000 were paid off, a fall in prices of one quarter would be enough to balance this advantage.

The gross produce of agriculture in Switzerland amounts at present to £37 670 000; three quarters of this, or in round numbers £28 000 000, are sold. The debt requires, at 4.5 per cent., about £6 700 000 for interest. The fall in prices would thus somewhat exceed the saving of interest.

With prices of produce lowered below the cost of production, the position of the peasants who had debts would not be improved but would be rendered worse, because the question of indebtednes is not so much a question of the price of land, which it is hoped to reduce by the introduction of lower prices of produce, as chiefly a question of the ratio between income and the rate of interest. So long as the agricultural net returns yield a higher rate of interest on capital than the interest that the peasant has to pay on his debts to the banks, the peasant with scanty capital can work in his farm with borrowed capital and still make a profit. On the other hand, when the low prices of produce cause the net returns from farming to sink below the rate of interest on loans, the peasant without sufficient capital or burthened with debts must end in ruin.

The most efficient method of solving the problem of indebtedness consists, according to the writer, in adopting in all transactions with farms, especially in the division of inherited land, their revenue as the basis of all valuation.

AGRICULTURAL INDUSTRIES.

INDUSTRIES DEPENDING ON PLANT PRODUCTS

1051 – **Vinification by means of Ferments other than Wine Yeasts.** — MARTINAND, V., in *Revue de Viticulture*, Vol. XLII, No. 1073, pp. 29-34. Paris, July 9, 1914.

From 1889 to 1901 the writer had studied the specific ferments of fine wines and of the grapes producing them, in collaboration with M. Rietsch; he has now isolated all the cellular ferments present on the ripe grapes of a celebrated wine. Among them are several micro-organisms which are not yeasts and which yield very little alcohol, but which impart a very agreeable fruity flavour absent from wines fermented only by the elliptical ferments.

To determine whether the Burgundy vineyards contain more of the elliptical ferments than those of the South of France, the writer repeated

Pasteur's experiments in a vineyard near the Romanée-Conti property. Of 60 grapes, only one was found to contain elliptical yeasts; four apicular yeasts, two torulae, one fungal yeast (having the characters of both *Mycoderma vini* and a yeast) and six ferments causing turbulence in must, but capable of liquefying gelatine, were also found; the remaining micro-organisms were moulds, *Botrytis cinerea* and *Penicillium glaucum* being dominant; two tubes contained no micro-organisms capable of developing in must. The bacteria were not investigated in these experiments.

The fact that the true elliptical wine yeasts occurred on only one grape is in conformity with their general rarity in the vintage.

The organisms other than the elliptical yeasts produce little alcohol, but it does not follow that they are not able to utilise grape sugar. The evolution of carbon dioxide is not a sufficient index of the activity of the ferments of the grapes. Further, these organisms possess in different degrees the power of secreting diastases which dissociate albuminoid matter more actively than the yeasts. They are also able to free the must and wine more or less rapidly from any free sulphurous acid which they contain.

The following means of utilising these ferments in vinification is distinct from the use of selected yeasts and enables sulphurous compounds to be used when desired. Cultures of the selected ferments are made separately or mixed in must containing grape sugar, and they are supplied to vine-growers at the same time as the alcoholic yeasts. They are used as follows: a starter is prepared by cultivating the ferments in must and 20 litres of the must are used for every 100 h.litres of the wine; this must is allowed an incubation period of 24 hours. The starter is then added gradually as the must is put into the vat; the culture of elliptical ferments is added at the same time, without previous incubation. Twenty-four hours after the vat is full, a considerable quantity of must is drawn off from below and added above. Fermentation proceeds very rapidly and it is advisable to cool the floating grape-skins by spraying each morning with must from the bottom of the vat.

A culture of selected ferments other than those belonging to *Saccharomyces ellipsoides* has been employed; it does not produce more than 6 per cent. of alcohol. Another culture of alcoholic yeasts has been applied either to the starter of pure yeasts or direct to the vintage.

Sulphurous compounds, if used, should be applied only during the initial racking off and not on the grapes during fermentation. The amount should be less than in ordinary vinification, and it should only be used in the later racking if the temperature of fermentation rises too high, viz. above 35° C. (87° F.).

The writer considers that the selected ferments are used in large quantities in order to dominate the microflora, and the alcoholic yeasts added in less quantity are only able to complete the fermentation of the sugar to form alcohol. The micro-organisms of the selected cultures promote the activity of the alcoholic yeasts. The rapidity of fermentation prevents the growth of disease germs. Thus sulphurous compounds are unnecessary and are only added when the fermentation diminishes. Sulphurous acid gives

the wine considerable quality and by means of numerous comparative experiments it will be possible to limit or extend its use.

The writer points out the advantages to be derived from the use of selected ferments in connection with pure yeasts. The fresh fruity wines of the Beaujolais, as well as the Aramon wines from the South of France, much liked for this reason, will improve considerably when prepared by this method. The yeasts possessing a characteristic bouquet, like those of champagne, retain their quality in the presence of these selected ferments. The danger from a later fermentation in the bottle as in the case of sulphited wines, does not exist with wines prepared by this method of fermentation.

1052 – **Physico-Chemical Volumetric Estimation of Potash and Magnesia and its Application to Wines.** — DUBOUX, M., in *Comptes Rendus hebdomadaires des Séances de l'Académie des Sciences*, Vol. 159, No. 4, pp. 320-323. Paris, July 27, 1914.

M. Duboux proposes to extend the application of the electrical conductivity method (1) to the estimation of potash and magnesia, which had not yet been studied.

The potash is estimated in neutral solution after the addition of 18 times its volume of 95 per cent. alcohol by determining the conductivities after successive additions of platinic chloride. Magnesium is determined by the changes of conductivity of the solution to which 0.02 per cent. of ammonia and 0.06 per cent. of ammonium chloride have been added, induced by successive additions of a semi-normal solution of phosphoric acid. In estimating these substances in wines the organic matter must be previously removed.

The volumetric method gives results sufficiently consistent with those obtained by the customary gravimetric method, but generally about 0.01 gm. per litre below them.

1053 – **The Influence of Radioctive Emanations on Yeasts and Alcoholic Fermentation.** — JACQUEMIN, G., and GIUREL, G., in *La Vie Agricole et Rurale*, Year III, No. 35, p. 232. Paris, August 1, 1914.

Radioactive emanations have a marked action on alcoholic fermentation and yeasts, exerting a stimulating action from the moment of inoculation of the medium and the growth of the elliptical yeasts until the final stages. The transformation of sugar is more complete and the yield of alcohol is greater by several tenths of a degree in most radioactive media. A radioactivity of ½ to 1 unit per litre exerts a beneficial action on yeasts and accelerates the breaking-down of saccharine organic compounds, just as in the case of the mineralization of nitrogen by nitrifying organisms.

The increased activity and alcohol-yielding capacity of radioactivated yeasts is of great advantage in many fermentation industries and notably in vinification.

(1) See article by P. DUTOIT and M. DUBOUX: "Analysis of Wines by a Physico-Chemical Volumetric Method". — *B.* Dec. 1912, pp. 2562-2569. Also, No. 947, *B.* Oct. 1914. (*Ed.*).

1054 – **Some Products of the Banana.** — *Queensland Agricultural Journal*, Vol II, Part 1, pp. 40-41; Part 2, pp. 150-152. Brisbane, July and August 1914.

It has been calculated that in all exporting countries there are probably 8 000 000 bunches of bananas that annually fail to come up to the standard required by shippers. These 8 000 000 bunches, at 6 *d* each, amount to £200 000 per annum. This shows the importance of the problem of their industrial utilization.

The writer describes the methods of preparing dried bananas, or " banana figs ", banana meal, banana wine (obtained by the spontaneous fermentation of the fruit mixed with water, but which keeps only a short time), and banana alcohol or whisky. Bananas analysed by Corenwinde showed that they contain as much as 22 per cent. of sugar, 16 per cent. of which is crystallizable; hence the conclusion that they might produce an excellent alcohol. At the Central Laboratory of Guatemala experiments were conducted which led to the production of a good spirit something like whisky. Samples of this spirit that had been only six months in the barrel were sent to the St. Louis Exhibition where they were much appreciated. The cost of manufacture is said to be much less than that of ordinary whisky. The yield may be estimated at about 1 gallon per bunch of bananas. The cost of a plant capable of producing 150 casks of whisky daily is estimated at about £34 500. This estimate includes buildings, machinery, apparatus, fuel, labour, administration, general expenses for two years, cases and bottles for one year and raw material for manufacture for two years, namely 270 000 bunches at 7 ½*d* each.

1055 – **Studies on the Extraction of Olive Oil.** — VENTRE, JULES (Ecole Nationale d'Agriculture de Montpellier) in *Annales de l'Ecole Nationale d'Agriculture de Montpellier*, New Series, Vol. XIII, Part IV, pp. 249-269. Montpellier, April 1914.

I. — *Formation of the oil in the olive and its relation to the time of harvest and storage.* — Experiments were conducted to determine how far it is true that the yield of oil is increased by delaying the harvest of the fruits. The results are set forth in Table I and show that the increased yield of oil after maturity is only apparent, being due largely to loss of water by evaporation.

TABLE I. — *Composition of olives at various stages of maturity.*

	Date of gathering			
	November 15 unripe, skin of a yellow rose colour	December 3rd skin reddish	December 21 ripe and black not wrinkled	January 10 end of season fruit shrivelled
Weight of one olive . . . gms.	1.685	1.650	1.615	1.512
No. of olives per litre	350	392	420	458
Weight of 1 hl. . . . . kg.	58.975	64.680	67.830	69.250
Water in fresh olives . . . %	40.85	38.92	36.74	30.93
Oil in fresh olives . . . . %	17.2	20.85	24.16	25.63

In order to determine whether continued maturation on the tree influences the formation of oil, batches of fruits were stored in a dry atmosphere from the 15th of November to the 10th of Jannary. The percentage of oil was determined at three different periods during this time and the results compared with the analyses of similar fruits gathered fresh from the trees at the same times as those taken from storage. The results are given in Table II.

TABLE II. — *Comparison between the oil-content of fresh olives and stored olives at different stages of maturity.*

Date of gathering or removal from storage	Stored olives			Fresh olives		
	Moisture % of fresh olives	% of oil in		Moisture % of fresh olives	% of oil in	
		fresh olives	dried at 105°		fresh olives	dried at 105°
November 15	—	—	—	40.85	17.2	29.1
December 3.	33.23	22.64	33.92	38.90	20.85	35.15
December 21	23.6	28.42	37.20	36.65	24.16	37.60
January 10.	20.62	30.48	38.40	30.92	25.63	37.12

It is seen that the proportion of oil to dry matter is sensibly the same in stored and freshly gathered fruits. On the 15th of November the olives contained 40.85 per cent. of water and on the 10th of January only 20.62 per cent. ; by calculation from the 17.2 per cent. in the dry matter on Nov. 15, the stored fruits should contain 23.32 per cent. on Jan. 10, while the actual result obtained by analysis was 30.48, thus showing an increase of 7.16 per cent.

These results also show that harvesting the fruit too late diminishes the yield of oil. Olives may therefore be safely stored for a certain time provided they are placed in layers not exceeding 16 inches in thickness and the storeroom is kept ventilated.

Heated olives give a higher yield of oil. The best temperature is beteween 35 and 40° C. (95 and 105° F.) and is obtained by natural fermentation at the end of 6 to 8 days after storing according to the above conditions. Should spontaneous fermentation proceed too far, or if mouldiness appear, the oil will be acid and very inferior.

From these results the writer draws the following conclusions :

1. The yield of oil from olives increases from the beginning to the end of maturity, chiefly owing to the loss of moisture by evaporation and the consequent increase in the proportion of the other constituents.

2. The olive contains a sufficient quantity of reserve material to be transformed into oil during storage, and ripening may continue after harvesting the fruits as in the case of other fruits.

3. The best time for harvest is during the second and third periods of maturity, when the skin is red or black and without wrinkles.

4. Storage under rational conditions in no way endangers the quality and maturation of the fruit for industrial purposes.

II. — *Comparisons of mechanical and hydraulic presses.*

The results of experiments with the hydraulic press are given in Table III. Treatment A consisted in subjecting the paste of olives ground for half an hour on a small mill stone, to a maximum pressure of 260 000 lbs maintained for 80 minutes, The oil thus obtained was of superior quality.

Treatment B consisted in subjecting the paste to a preliminary pressure of 150 000 lbs. for 25 minutes, after which the baskets were emptied and the paste placed in the finishing press, taking care to add 2 litres of warm water at 80-85° C. to each basket. The pressure was then raised to 260 000 lbs. for 55 minutes. The liquid of the different pressures was collected separately ; the first was of fine quality, the second had a less agreeable dry taste.

Treatment C was exactly similar to the preceding, with the difference that the water used was at a temperature of 15° C. The separation of the watery layer was more rapid than in the preceding case and the second oil extraction was considerably improved; it was considered advisable to mix the two qualities of oil and obtain a unique product of superior quality. Treatment D differed from B and C in omitting the addition of any water to the pressed paste. The quality of the oil obtained at both pressures was superior to that obtained by treatment B.

Treatment E was like treatment B, but the duration of the pressure was doubled, 40 minutes in the preliminary press and 80 minutes in the final press. The product obtained in this case was inferior to all the preceding.

Table III shows that the yields were almost equal by each method, excepting the slight increases when water was added.

The use of cold water, which does not injure the product, should not be neglected in large factories.

The experiments of which the results are summarised in Table IV were conducted in a mechanical lever press, with a pressure of about 167 000 lbs. The proceedure was analogous to that of the preceding experiments ; in A the pressure was maintained for 100 minutes, in E each pressure was applied for 1 hour.

Comparing Tables III and IV it is seen that the yield of oil from the first operation is greater with mechanical presses than with hydraulic, but the total yield of oil is greater from the latter.

The residues of the two series of experiments were analysed. The Table shows that the residues of the first series (hydraulic presses) contain in the average of the treatments 10.16 per cent. of oil (in terms of dry matter), whilst the residues of the second series (mechanical presses) contain 11.59 per cent.

It was observed during these experiments that the degree of grinding

TABLE III. — *Experiment with hydraulic presses.*

		Treatment				
		A.	B.	C.	D.	E.
Yield of oil per 100 kg. of fresh olives.	1st Pressure (preparatory)	—	14.95	15.1	14.8	13.05
	2nd Pressure (final):					
	a) without water	16.85	—	—	2.1	—
	b) with warm water	—	2.50	—	—	2.35
	c) » cold water	—	—	2.2	—	—
	Total	16.85	17.45	17.3	16.9	17.40
Percentage of total oil obtained.	1st Pressure	—	70.7	71.4	70.0	71.15
	2and Pressure	79.7	11.8	10.4	10.0	11.1
Residue, % of fresh olives		42.1	43.7	40.4	46.3	43.8

TABLE IV. — *Experiment with mechanical presses.*

		Treatment				
		A.	B.	C.	D.	E.
Yield of oil per 100 kg. of fresh olives.	1st Pressure	—	15.75	15.95	15,80	16.13
	2nd Pressure:					
	a) without water	16.2	—	—	0.55	—
	b) with warm water	—	0.85	—	—	0.72
	c) » cold »	—	—	0.45	—	—
	Total	16.2	16.60	16.40	16.35	16.85
Percentage of total oil obtained	1st pressure	—	74.47	75.36	74.7	76.20
	2nd pressure	76.6	4.00	2.13	2.6	3.46
Residue, % of fresh olives		59.9	54.4	57.1	54.3	53.4

has no essential importance with respect to yield of oil, and that if it is too extreme the yield is actually diminished.

The conclusions drawn from these experiments are:

1) Hydraulic presses are always capable of excellent returns, with regard to both yield and economy of time.

2) Mechanical presses, when well made, can yield almost as good results as hydraulic presses under certain conditions.

3) Hydraulic presses should be employed in large installations where the increased yield will compensate for their heavy expenditure.

4) Apart from the pressure, the addition of hot or cold water results in an increased yield.

5) As a general rule the yields obtained by the use of cold water are about equal to those obtained by hot water.

1056 – **Some Data on Peanut Butter** (1). — UTT, C. A. A. (Kansas State Agricultural College, Manhattan) in *The Journal of Industrial and Engineering Chemistry*, Vol. 6, No. 9, pp. 746-747. Easton, Pa., September 1914.

The writer analysed 23 samples of peanut butter bought on the Kansas market and found that the percentage of oil varied between 46.44 and 53.64. The refractive index at 25° C. ranged from 1.4680 to 1.4707 and the iodine value from 88.76 to 94.36. He further prepared three samples of roasted peanuts reduced to butter-like consistency and found their characters to be within the above limits. Another sample was prepared by roasting peanuts brown in olive oil and then grinding them as finely as possible. It was found to contain 55.48 per cent. of oil and its refractive index was 1.4620.

According to BEATTIE some fresh peanuts may contain as much as 50 per cent. of oil ; after roasting the oil content would be higher owing to a corresponding loss of water. The writer concludes that finding more than 50 per cent. of oil in peanut butter does not warrant its being declared adulterated by the addition of other oil. That added oil can be detected is seen in the lowering of the refractive index by the use of olive oil.

1057 – **The Japanese Seaweed "Tosaka Nori."** — COTTON, A. D., in *Royal Botanic Gardens, Kew, Bulletin of Miscellaneous Information*, No. 6, pp. 219-222. London, 1914.

Professors Cotton and Yendo have identified and named *Eucheuma papulosa* the edible Japanese alga known in Japan as "tosaka nori", and which had been described under several other names. It is found in the Red Sea, and in the seas near Somaliland, Formosa, Japan, Guadeloupe and the Sandwich Islands. In Japan it is much esteemed. It is often collected by divers in a depth of 10-12 fathoms along open coasts in the middle and southern parts of the country. Large quantities of the plant are, however, obtained by picking up the floating fronds with scoop nets after rough weather in early spring. The weed is dried in the sun and sold in the markets. It is prepared into isinglass and is used as food. A certain amount is also exported annually to China, where it is known as "hong-tsay" (crimson weed).

(1) See No. 65, *B.* Jan. 1913. (*Ed.*).

058 – **Bacteriological Enquiry on Sterile Milk Sold in Brussels.** — KUFFERATH, H., in *Annales de Gembloux*, Year 24, Bk.8, pp. 417 424. Brussels, August 1914.

From the results of 17 samples the writer draws certain conclusions oncerning milk sold as "aseptic" in Brussels. Comparing the results obtain-d by the use of aseptic milking with those already published on the rdinary milk delivered in the city of Brussels, the progress made by dairy-nen becomes apparent. The writer had found that the ordinary milk ontained on an average 1 388 430 germs per cc., whilst in the 17 samples bove mentioned only 17 263 germs per cc. were found. These results how the importance of the establishment of official bacteriological control or milk supplies and the value of such a service to the public.

Of the 17 samples examined, two were found to contain *coli* bacilli. Sterile milk should be such that it may be safely consumed without boiling. It is therefore evident that the greatest care should be taken to observe strictly all regulations.

The Belgian Permanent Milk Commission asked the writer to determine a maximum limit for the number of germs allowable in sterile milk. This standard should be about 50 000 germs per cc., estimated by counts on gelatine plates kept for 3 days at a temperature of 38° C. At the same time no injurious bacilli such as *coli* and tuberculosis germs must be allowed.

1059 – **Payment for Milk and Cream Supplies.** — CUDDIE, in *The Journal of Agriculture.* Vol. VIII, No. 3, pp. 295-299. Wellington, N. Z., March 1914.

While the purity of milk (that is the lowest possible content of micro-organisms) is of the greatest importance for making cheese and butter of the very best quality, milk supplied to dairies continues to be paid for according to fat content alone. As all the lots of milk are mixed and worked up together the least pure lots reduce the best to a lower common standard, and the injury caused only by the least careful dairy farmers is felt equally by all.

The official inspection of milking sheds, yards, etc., has only a partial success in raising the standard of purity in factory supplies. The writer therefore proposes that a reduced price per pound of butter-fat be paid for those quantities of raw material which can yield produce of only indifferent quality, and a premium be given for those deliveries which possess a high degree of purity.

In order to introduce such a scheme it would, of course, be necessary to have the milk and cream from each farm classified by a competent and independent officer, who would visit the factory for the purpose, not less frequently than once a week. The date of his visit should not be known to the suppliers.

A sample representative of the day's supply should be taken on the day of the officer's visit and submitted to the "curd test".

This test has been tried over a long period of years and has been found to be thoroughly reliable as an indicator of the purity of the milk, although it does not appear to have ever been applied to the grading of milk for payment purposes.

The samples submitted to the grading officer for examination need bear only a number and not the name of the owner. The grader would record his decision and hand a copy of his results to the secretary of the company concerned, who would credit each supplier with the grade recorded for that particular period. The number of days covered by this test might be made coincident with the period covered by the test for butter fat, which would simplify the work.

The men selected to undertake the grading should be appointed by Government. If the work were properly organized, in most districts several neighbouring factories might agree to have the same inspector, which would make the expense to each very moderate.

The writer is convinced that the adoption of the scheme outlined above would eventually raise the value of New Zealand butter and cheese by at least 3*s* or 4*s* per hundredweight. In fact the best New Zealand cheese exhibited at the last Dunedin Winter Show and then sent to London, where it was placed on exhibition, was sold 4 to 5 *s* per cwt. more than New Zealand cheese was bringing on the market at the time.

1060 – **The Influence of Foot-and-Mouth Disease on the Composition of Milk and Butter.** — Bordas, F., and De Raczkovski, S., in *Annales des Falsifications*, Year 7, No. 68, pp. 271-292. Paris, June 1914.

After giving a résumé of the question which has interested the chemists and magistrates appointed for the suppression of frauds (1), the writers furnish additional information for the solution of this problem. The researches were made with samples of milk taken with all possible care in the presence of the local veterinary surgeon in places where foot-and-mouth disease had been reported. The results of the analyses of diseased and healthy milk from the same cowsheds have been compared with the average obtained the same day from milk collected throughout the district.

The changes in the composition of the milk and butter due to this disease are as follows:

1) *Milk.* — A notable increase in the proportions of fat and mineral salts, especially chlorides, and a decrease in the percentage of casein. There is apparently no change in the percentage of lactose, except that in the case of milks from cows in the height of fever and of those with abnormally high fat content there is a decrease in lactose accompanied by a corresponding increase in ash. The percentage of organic phosphorus and the acidity remain unchanged. Milks in which solids-not-fat fall below 86 gms. per litre are rare.

2) *Butter.* — Examination of butter from a single badly diseased cow might lead one to suspect addition of about 25 per cent. of margarine, whilst that from a herd of cows more or less infected would be suspected of an addition of 5 to 6 per cent. The conclusions of the writers confirm those put forward by French Analysts.

Thus, though it is true that the milk from a single cow or a small number of cows in the same shed, or that the butter obtained from a small quantity

(1) See No. 2783, *B.* Aug.-Sept.-Oct. 1911; No. 954, *B.* Aug. 1913. (*Ed.*)

of infected milk may show an abnormal composition, the collected milk or the butter centrifugalised from it never show any defects such as would make them unsaleable.

1061 – **New Observations on the Origin of the Taste of Swedes in Butter.** — WEIGMANN and WOLFF, in *Landwirtschaftliche Jahrbücher*, Vol. 46, Part 3, pp. 343-365. Berlin, May 15, 1914.

In the 37th volume of *Landwirtschaftliche Jahrbücher* one of the writers demonstrated that the taste of swedes in butter it to be attributed, for the most part, to bacterial action and only for the very least part to a somewhat stronger smell and taste of the cow than is found in ordinary milk. He further recognized that the bacteria which caused this secondary flavour are not new and special ones, but those which are generally found in milk, especially *Bacterium coli*, lactic acid bacteria, *Actinomyces odorifer*, besides some mycelia rarely found in milk.

Since the above publications the writers studied further cases of the taste of swedes in samples of milk and butter. It was first established that the swede flavour was due to strains of *B. coli* together with other species, among which is to be mentioned *Bacterium fluorescens liquefaciens*, which possesses to a great degree the power of producing the taste of swedes and of carrots in milk. The observations on the latter taste were made on the occasion of investigating a milk which was designated as " bitter " and subject to " premature curdling ", in which this bacterium was prevalent together with members of the *coli-aerogenes* group, short alkaline bacilli and cocci. The glass plates on which the milk was laid smelt distinctly and strongly of carrots, and the milk inoculated with the isolated bacteria took after 24 hours the same strong taste and smell.

The taste of swedes caused by *Bacterium fluorescens liquefaciens* is exceedingly acute and strong, and could be studied in a number of cases. In several occasions, when the above bacterium was present, instead of the swede taste a fine pineapple or strawberry flavour could be detected. In other instances the *Bacterium fluorescens* did not produce the swede taste when alone but only in the presence of other bacteria, especially of lactic acid bacteria. The latter alone may even be the cause of the defective taste of the milk, from which it follows that they also are capable of giving the swede taste to butter. This is perhaps rather more a taste of " fodder ", which becomes stronger and more distinctly swede-like as soon as other bacteria or fungi possessing similar properties are present.

In all the cases mentioned the writers have found bacteria which possess the power of producing such tastes and odours. It may thus be inferred that the substances giving these tastes and odours are due to properties of the bacteria acquired during their evolution, which properties the writers attribute chiefly to the nutritive medium or to the medium in which the bacteria live.

The experiments made, show that these odorous substances of the nutritive medium are partly directly transmitted and are partly due to the production of substances which do not exist in the nutritive medium but are formed from the components of the medium. It may be admitted

as certain that every group and species of bacteria has its specific action as to taste. Whether the same nutritive medium under the action of different bacteria gives rise to the same taste remains to be investigated.

1062 – **The Odessa Cattle and Meat Supply.** — *Daily Consular and Trade Reports Issued by the Bureau of Foreign and Domestic Commerce*, Year 17, No. 196, pp. 1004-1005. Washington, August 21, 1914.

The Russian cattle industry is continuously declining and the meat producing centres are gradually receding to the outskirts of the country; nevertheless there is no scarcity of forage and the breeds are improving considerably, as has been shown by the recent livestock exhibition at Petrograd. There were no oxen weighing less than 542 lbs. and some weigheed as much as 1264 lbs.

During the last three years the following animals were slaughtered at the Odessa abattoir :

	1911	1912	1913
Cattle	132 566	119 397	125 474
Calves	26 522	25 412	26 343
Sheep	68 963	84 911	88 114
Lambs	46 935	43 159	53 398
Swine	41 825	53 924	61 797

Cattle and other animals intended for consumption must be killed and prepared at the city abattoir. Only such animals as have been inspected by its veterinary surgeons are allowed to be killed, and after slaughter the meat is again inspected as well as all prepared meat brought into the city. All meat intended for exportation must also be accompanied by a certificate from the veterinary of the National Government. A small quantity of meat is sent from Odessa to other Russian ports on the Black Sea.

The Odessa cattle market, the largest in South Russia, supplies many neighbouring towns and determines the prices of meat animals for a wide radius. In 1913 the following animals were brought to the Odessa market : oxen 39 965 ; cows, 48 286; heifers 76 464; calves 1556. Most of the cattle and meat supply of the city is brought from within a radius of 200 to 300 miles.

The following table shows the average wholesale prices per 100 pounds of various meats during the last three years :

Years	Beef	Veal	Mutton	Pork
1911	$ 7.75	$ 15.00	$ 6.80	$ 8.30
1912	8.00	15.75	8.55	8.90
1913	7.80	15.00	7.50	8.50

The retail price of beef has risen during the last seven years from 7.2 cents per lb to 11.1 cents.

In considering these prices it must be remembered that the animals are not of improved breeds and that the method of cutting up provides the buyer with much waste.

Much attention is given to the treatment of by-products at the city abattoir. The blood is mostly dried and powdered. The entrails are used chiefly for feeding swine and fowls. The intestines are worked up locally into sausage casings and musical instrument strings, and occasionally small quantities are salted for export. Most of the fat is used in the local industries, especially that of soap making, partly also in the manufacture of margarine. Some mutton fat is exported to Turkey. Hoofs and horns are for the most part worked up by factories in Central Russia. Almost all the hides go to local tanneries. The contents of stomachs are desiccated and carted to the Odessa irrigation fields, where they are ploughed into the poorest soils, which are a mixture of brackish sea sand and clay carried down by the rains.

When amply manured, treated with the city's waste waters and cleared of salt, the ground is good for kitchen-garden produce.

1063 – **The Wool Clip in Australasia in the Year 1913-1914.** (1) — *The Agricultural Gazette of Tasmania*, Vol. XXII, No. 7, p. 254. Hobart, July 1914.

The number of sheep estimated to have been shorn in the Commonwealth and New Zealand in the season 1913-14 was 109 692 264 head, including lambs, and they produced 7.87 lbs. per fleece as against 7 lbs. for the previous season. An average monetary return of 6*s* 4*d* per head was realized, the total value of the wool clip being £34 957 463. The oversea exports of wool, plus the quantity retained for manufacturing purposes, give a total of 2 639 280 bales. The average sale price per bale was £13 4*s* 11*d* and the total amount of all the wool sold in Australia and New Zealand was 1 968 578 bales, while 10 years ago only 837 497 bales were sold. The increase in the value of the wool clip sold in Australasia in 10 years amounts to no less than 160 per cent.

(1) See also No. 837, *B.* July 1913 and No. 1119, *B.* Oct. 1913. (*Ed.*).

PLANT DISEASES

GENERAL INFORMATION.

LEGISLATIVE AND ADMINISTRATIVE MEASURES

1064 – **Decree of the Governor of the Colony of Eritrea, dated 13 July 1914, (No. 2026), concerning the Protection of Plants.** — *Bullettino ufficiale della Colonia Eritrea*, Year XXIII, No. 29, pp. 221-222. Asmara, July 16, 1914.

Art. 1. - Proprietors and directors of horticultural establishments and nurseries in Eritrea producing plants, parts of plants and seeds, or engaged in their sale, are required to declare this to the regional commissioner.

The Colonisation Department has the right to inspect crops and vegetable products wherever they may be stored, and, if they are considered infected, to prevent their sale or order their disinfection.

Art. 2. — Officers acting under the instructions of the Director of the Colonisation Department have the right of entry into all properties, irrespective of the crop or use of the land, to ascertain whether diseases are present, and according to the provisions of this decree and special enactments, they have the power to take the necessary steps for the disinfection and care of infected plants.

Art. 3. — The introduction of agricultural, forest and ornamental plants and parts of plants or seeds from Italy is forbidden, unless they are accompanied by a certificate indicating their origin and declaring them to be free from plant diseases liable to endanger the production of crops or useful wild plants in the Colony.

Art. 4. — The certificates referred to in the preceding article should be signed by the Directors of the State Phytopathological or Entomological Stations or Laboratories, or by the Directors of State Institutes or Experiment Stations authorised to grant such certificates.

Art. 5. — The importation of plants, parts of plants and seeds from foreign countries is in general forbidden. In exceptional circumstances the Colonisation Department will be able to grant special permission for the introduction of plants, parts of plants and seeds from foreign countries when certified to be free from dangerous diseases by competent persons appointed by the Department itself.

Art. 6. — Plants not considered free from diseases dangerous to the cultivation of crops or economic plants in the Colony will be destroyed without any compensation being allowed to the owner. The destruction of plants is placed under the charge of the Director of the Customs Office.

Art. 7. — Contraventions of this decree or of regulations to be published for the execution of the decree are punished by a fine of from 8*s* to £ 4, without excluding more serious penalties for violations of provisions of the Italian Penal Code. Contraventions of the prohibition of importation and conveyance shall be liable to a penalty not less than 8*s* and not exceeding £ 12, without excluding more serious penalties for contraband.

Art. 8. — On the proposal of the Director of Colonisation, special dispositions concerning the following matters may be published :

a) destruction of stubble and crop refuse liable to endanger the cultivation of other crops in the Colony;

b) prohibition of growing certain crops or of certain methods of cultivation liable to cause damage to cultivated or wild plants of economic value to the Colony;

c) prohibiting cultivators from allowing plantations of trees to be neglected if they are attacked by injurious parasites ;

d) enforcing definite treatment for the disinfection of plants, parts of plants and seeds introduced into the Colony ;

e) enforcing the use of remedies and the means of control against plant diseases, injurious insects and other plant pests, in cases in which the efficacy of the above measures depends upon the cooperation of all interested, and in cases of neglect to observe these orders, the carrying out of the necessary treatment at the expense of the defaulters.

Art. 9. — Special decrees will be introduced concerning the publication of provisions which may be required for the control of specially injurious pests or for the more effective protection of special crops.

DISEASES NOT DUE TO PARASITES OR OF UNKNOWN ORIGIN.

1065 – **The Contortion and Breaking of Wheat Straw.** — Darnell-Smith, G. P., in *The Agricultural Gazette of New South Wales*, Vol. XVI, Part 5, pp. 377-378, 1 fig. Sydney, 1914.

In several districts of New South Wales, especially at Nyngan, Wagga and Cowra, it has been observed that wheat is subject to a malformation or twist of the stem as though its normal development had been restrained. The stem is thus weakened and is liable to be broken by the wind when the grain is ripe. In some cases this is so common that the crop appears to have been trampled under foot.

The natural strength of the straw does not appear to have any considerable influence on the prevalence of this phenomenon. In explanation it has been suggested as being caused by insect attacks and also by disproportionate growth of the stems.

Similar cases were also recorded at Carrathool and Deniliquin in 1900, and in the former place it was said to be caused by the bites of aphides during the early stage of growth.

Examination of the diseased straws in 1912-13 did not show the presence of any insect or fungus disease, nor were aphides found on the wheat at Nyngan, Wagga or Cowra in 1914.

According to Maiden, the Government Botanist, who examined several stems, the centre of the disturbance is situated near the lower nodes of the stem. He also remarks that a similar phenomenon has been described as " contortion " by Masters and according to him it is generally produced by retarded growth in certain directions or abnormal growth in others.

Unfortunately, neither attacks of aphides nor abnormal growth due to irregular rainfall admit of the application of remedial measures.

BACTERIAL AND FUNGOID DISEASES.

GENERALITIES

1066 – **Parasitic Fungi collected in the Straits Settlements and Fiji Islands.** — *Royal Botanic Gardens, Kew, Bulletin of Miscellaneous Information*, 1914, No. 4, pp. 156-159. London, 1914.

Among the 11 species enumerated, the following described by Massee as new to Science are worthy of mention from a phytopathological point of view: 1) *Cyphella Hcveae* collected in Province Wellesley on the bark of *Hevea brasiliensis* and undoubtedly parasitic on this plant; it is allied to *C. villosa* Karst.; 2) *Botrytis necans* observed in the Botanic Gardens at Singapore on the larvae of *Brachastona catoxantha* (Lepidoptera), which is effectively kept in check thereby; 3) *Cercospora Musae* parasitic on the leaves of bananas in the island of Viti Levu (Fiji). It is considered to be the cause of a serious disease in estates in the Sigatoka district. Infected leaves fall early: generally the lowest leaves are attacked first and the disease spreads upwards.

FUNGI

1067 – **The Presence of the Hybernating Mycelium of *Macrosporium Solani* in Tomato Seed.** — MASSEE, I., in *Royal Botanic Gardens, Kew, Bulletin of Miscellaneous Information*, 1914, No. 4, pp. 145-146, 1 plate. London, 1914.

It has long been suspected that the spores of " black rot " of tomatoes (*Macrosporium Solani* Cke.) were contained in the seeds, but the actual presence of the fungus had not yet been demonstrated. When the fruits are attacked by the fungus the seeds show black spots on their surface. In 1906 G. Massee showed that the plants derived from such infected seeds were often attacked by " black stripe " disease of the stem due to *M. Solani*. Microtome sections of these spotted seeds show the presence of the mycelium of the fungus.

In a healthy tomato seed, the external integument is in intimate contact with the endosperm, whilst in an infected seed there is a thick layer of hyphae between the two.

In the case of badly damaged fruits the mycelium extends below the diseased zone and in many cases the placentas are completely invaded by a thick web of mycelium, which renders them quite black. The seeds attached to these placentas are often attacked by the mycelium, which penetrates the micropyle. The web of mycelium sometimes forms a uniform layer round the endosperm; in other cases it is of variable thickness or only represented by local patches. The hyphae extend from the periphery to the endosperm and also to the embryo, probably dissolving the thin cell-walls by means of a ferment. When the end of a hypha comes in contact with a cell-wall, it flattens and swells, a small portion of the centre then penetrates the cell-wall and swells out on the other side to its normal size. In other cases the penetration of the hyphae is effected without the flattening and swelling out. No haustoria are found.

On the germination of infected seeds, the embryo is destroyed almost immediately by the mycelium if it is present in quantity, or the mycelium continues to grow in the tissues of the young plant where it may easily be found. Infected plants show the "black stripe" disease before they are two months old, if grown under favourable conditions for the growth of the fungus. Sections of diseased seeds which had been kept dry for several months became surrounded by a mass of mycelium when placed on damp filter paper in a Petri dish, thus showing that the mycelium retains its vitality for a considerable time inside the seed. In numerous cases when the seed from a diseased fruit does not contain mycelium in its interior, it is surrounded on the exterior by a web of mycelium which cannot be removed by the ordinary processes of cleaning, since it is held in position by the thick layer of hairs on the seed-coat.

This external mycelium is therefore a source of danger. The only certain means of avoiding the disease is by rejecting all seeds produced by diseased fruits, even those which do not show black spots.

1068 – **The Resistance of Different Varieties of Gooseberries to American Gooseberry Mildew *(Sphaerotheca mors-uvae)* and the Effect of Treatment with Sulphur.** (1) — KÖCK, G., in *Zeitschrift für das Landwirtschaftliche Versuchswesen in Oesterreich*, Year XVII, Part 6-7, pp. 634-637. Vienna, 1914. RESISTANT PLANTS

During 1913 the writer had the opportunity of studying the resistance to American gooseberry mildew (*Sphaerotheca mors-uvae*) of some hundred varieties of gooseberries, at Eisgrub (Bohemia). The effect of sulphuring (with "Ventilato") was also observed.

This rich collection of goseberries was examined on July 15th and it was found that of the red varieties the following were attacked by the disease: Chain Red, Drum Major, Guido Red, Overall, Raspberry and Roaring Lion (or Rote Preisbeere); on the occasion of a second visit on August 5th, Monstrueuse (or Rote Preisbeere) was found to be diseased. Of the green varieties the following were infested on July 15th: Duke of Bedford, Green Walnut, Keepsake, Plain Long Green, Smiling Beauty

(1) See also No. 884, *B.* July 1913; No. 1301, *B.* Nov. 1913; No. 183, *B.* Feb. 1914. (*Ed.*).

(Hellgrüne Samtbeere). The following yellow varieties were found diseased on July 15th: Globe Yellow (or Runde Gelbe) and Rockwood, whilst Yellow Lion was found diseased on August 15th. The only white variety attacked was Queen Mary.

Sulphuring caused leaf-fall in the following 56 varieties:

Aaron, Alexander, Antagonist, Apo lo, Britannia Red, Chain Red, Champagne Yellow, Companion, Conquering, Hero, Drum Major, Duckwing, Fleur de Lys, Frühe Weisse, Früheste von Neuwied, Green River, Grosse Rauhe Rote, Guido Red, Husbandman, Industry (or Rote Triumphbeere), Jaune Rouge, Jolly Miner, Jolly Printer, Keen's Seedling, Large Hairy, Leveller, Liberator, Migolez (or Red Walnut), Minima, Monstrueuse, Mount Pleasant, Oakmere, Overseer, Pitmaston Green, Plattrunde Himbeerstachelbeere, Pride, Prince of Orange, Prince Regent, Printer, Queen Caroline, Raspberry, Roaring Lion, Rockwood, Rose of Sharon, Rough Red, Sämling von Maurer, Sämling von Pausner, Sampson, Shannon, Smiling Beauty, Smith's Improved, Smooth Yellow, Teazer, Twigem, White Champagne, Yellow Eagle, Yellow Lion.

The following varieties resisted infection:

1) *Red:* Alicant, Alexander, Britannia, Bloodhound, Companion, Forester, Grosse Rauhe Rote, Industry, Jaune Rouge, Jolly Miner, Jolly Printer, Keen's Seedling, London, Migolez, Octavius Brown (Dans Mistake), Plattrunde Himbeerstachelbeere, Rough Red, Rose of Sharon, Sämling von Maurer, Twigem, Wonderful (Braunrote Riesenbeere), Ironmonger.

2) *Green:* Balloon, Aaron, Bumper (Rockwood), Emerald (Smaragdbeere), Früheste von Neuwied, Green Willow (Grüne Flaschenbeere), Green Yellow Seedling (Golden Lion), Green River, Independent, Jolly Angler (Grüne Riesenbeere), Lovely Anne, Lofty (Grüne Riesenbeere), Nettle Green (Dünnschalige), Pitmaston Greengage, Smith's Improved, Thumper, Frühe Weisse Hebbun, Green Prolific, Lady Delamere.

3) *Yellow:* Britannia, Catherina, Conquering Hero, Champagne Yellow, Duckwing, Golden Yellow (Marmorierte Goldkugel), Höning's Früheste (Früheste Gelbe), Husbandman, James Dawson Yellow, Liberator, Leveller, Lord Rancliffe, Minima, Prince of Orange, Printer, Rumbullion, Reveller, Smooth Yellow, Sampson, Triumphant, Two-to-one, Teazer, Yellow Eagle, Mount Pleasant, Stella.

4) *White:* Antagonist, Apollo, Date, Eagle, Fleur de Lys, Large Hairy, Primrose, Queen Caroline, Sämling von Pausner, Shannon, White Lion, White Champagne, Whitesmith.

The following showed no leaf-fall after treatment with sulphur:

1) *Red:* Alicant, Bloodhound, Forester, Over-all, Octavius Brown, Ironmonger.

2) *Green:* Balloon, Bumper, Emerald, Green Willow, Green Yellow Seedling, Green Walnut, Independent, Jolly Angler, Keepsake, Lovely Anne, Lofty, Nettle Green, Plain Long Green, Thumper, Duke of Bedford, Green Prolific, Lady Delamere.

3) *Yellow:* Britannia, Catherina, Globe Yellow, Golden Yellow, Höning's Früheste, James Dawson Yellow, Lord Rancliffe, Rumbullion, Reveller, Triumphant, Two-to-one, Stella.

4) *White:* Date, Eagle, Primrose, Queen Mary, White Lion, Whitesmith.

The observations concerning the disease resistance of each variety and the action of sulphur on the leaves will be continued.

1060 - **On the Composition of Alkaline Bordeaux Mixtures and their Soluble-Copper Content.** — VERMOREL, V., and DANTONY, E., in *Comptes rendus hebdomadaires des séances de l'Académie des Sciences*, 1914, 2nd Half-year, Vol. 159, No. 3, pp. 266-268. Paris, 1914

MEANS OF PREVENTION AND CONTROL

According to some authorities, the insoluble copper exists in Bordeaux mixture in the form of hydrate: according to others it is also present in the form of basic sulphates and double sulphates of calcium and copper. This work was carried out to determine the conditions of formation of these different compounds and to determine whether alkaline mixtures are free from soluble copper.

It was found that acid mixtures, apart from the free copper sulphate, consist almost entirely of the basic sulphates of copper of green colour to the exclusion of the hydrates of copper, whatever their mode of preparation. The precipitate has no immediate action on neutral solutions of ferrous sulphate.

Further, experimenting with exactly determined equal proportions of copper sulphate and lime, it is possible to produce two alkaline mixtures absolutely different, one being blue and the other green. On adding an excess of lime to a solution of copper, the blue hydrates or green basic sulphates of copper are produced according to the rapidity whith which the lime is poured in. When hydrates are formed, they consist chiefly of the stable hydrate of Péligot.

The quantity of copper in solution in blue alkaline mixtures, valued as sulphate, may reach 23 gms. per hl., but it diminishes on keeping. Besides the copper thrown out of solution, green alkaline mixtures contain both lime and copper compounds in solution; the proportion of copper valued as sulphate reaches 41 gms. per hl. but diminishes on keeping.

It follows that alkaline mixtures, contrary to the general opinion, always contain some copper in soluble form; and this amounts to about 2000 to 4000 times the amount required to prevent the germination of the spores of *Plasmopara viticola*. Consequently the objections to this mixture are unjustifiable.

1070 - **Potato Diseases in Victoria, Australia.** — BRITTLEBANK, C. C., in *The Journal of the Department of Agriculture of Victoria, Australia*, Vol. XII, Part 7, pp. 400-403. Melbourne, 1914.

BACTERIAL AND FUNGOID DISEASES OF VARIOUS CROPS

Since 1911, Victoria has, so far, been fortunate in not having to record any of the more serious diseases affecting potatoes in Europe and other countries. The only new disease, and one possibly of minor importance, is that commonly known as " dry scab " (*Spondylocladium atrovirens* Harz). Neither the " corky or powdery scab " (*Spongospora subterranea* [Wallr.] Johnson) nor " black wart disease " (*Synchytrium endobioticum* Percival) has yet made its appearance in this country. The former has, however, been detected in two separate shipments of potatoes from Europe, both being confiscated and destroyed.

From the serious nature of these diseases it would be as well, before too late, to prohibit totally and absolutely the importation of potatoes into Victoria from countries beyond the Commonwealth. Varieties suitable to the climate could be raised within the State, from seed either im-

ported from abroad or raised here. By adopting this course the danger of introducing either of the above diseases would be minimised.

During the past three years, examination of the consignments of potatoes from various countries, revealed the universally diseased condition of the tubers. Not a single consignment was free from disease. The following diseases were found to occur in one shipment alone: *Spongospora subterranea* (Wallr.) Johnson, *Phytopthora infestans* De Bary, *Rhizoctonia Solani* Kühn, *Spondylocladium atro-virens* Harz, *Fusarium oxysporum* Schlecht., *Oospora Scabies* Thaxt., *Bacillus Solanacearum* E. F. Smith.

1071 – **Fungus Diseases of Hevea in the Belgian Congo.** — VERMOESEN, in *Bulletin agricole du Congo belge*, Vol V, No. 2, pp. 312-321. Brussels, 1914.

During a stay at Bakusu, Coquilhatville, in the Belgian Congo, in January 1914, the writer examined the Hevea plantations for fungus diseases.

Only a single case of root-disease was found; probably the freedom from disease of the roots was due to the plantations being on a deep, well drained, sandy soil, as well as to the fact that the land was almost wholly cleared of trunks and stumps, which favour the spread of *Fomes semitostus* and other root parasites: it should be noted that this *Fomes* was found on two stumps.

The "die-back" disease of branches and trunk is very widespread at Bakusu. In the nurseries the damage is slight, only the tips of the branches being attacked generally, though in exceptional cases the main stem may be killed. The worst damage is just after planting out, when many trees succumb. In older plantations it is chiefly the younger branches which are attacked, the result being weakening of the tree.

The disease normally appears at the tips of the green branches, from which it works its way towards the base of the stem. On the bark appears a pale brown patch bounded by a sharp line, while the wood turns blackish grey. The infection often stops when it reaches the junction with a larger branch and almost always at the trunk. On old branches the disease is recognized by the loss of the leaves, in conjunction with the change of colour of the wood. The fruiting-bodies of the fungus causing the disease also appear: it is probably referable to *Diplodia cacaoicola*, which attacks Hevea, cacao, etc., in various tropical countries.

A few other parasites of no practical importance were noted, *viz.* a fungus near *Hypocrella* and an alga (*Cephaleuros*) on the leaves, and *Glocosporium* sp. and a fungus belonging to the Hysteriaceae on the twigs.

Root-disease should be combated by burning all wood infected by *Fomes semitostus*, as well as stumps and dead branches Care should be taken not to spread infected earth about, and after an infected tree has been removed the earth should be turned over to expose it well to the sun; lime may be added if obtainable; in any case fresh trees should not be planted for five or six months.

"Die-back" may be dealt with by spraying the young trees in the nursery with Bordeaux mixture; infected twigs or trees should at once be burnt. Older plantations should be gone over at least every two months to cut out infected wood. Vegetable tar should be applied to all wounds.

1072 – **Fungus Diseases of Cacao in the Mayumbe, Belgian Congo.** — VERMOESEN in *Bulletin agricole du Congo Belge*, Vol. V, No. 1, pp. 186-202, figs. Brussels, 1914.

These diseases are divided into four groups :

a). *Root diseases.* — They are very rare, only two or three very doubtful cases having been observed. This may be attributed to the resistance to root-diseases possessed by cacao and the fact that the first cacao plantaitons in the Mayumbe have been made on partially cleared forest land in which the trees were not all cut down, so that the soil is not covered with numerous trunks and dead stumps which favour the development of root parasites.

b). *Trunk disease.* — The chief external symptoms are a yellowing and sudden and simultaneous drying of all the leaves and twigs of the bush. Very often the disease spreads to the roots. On removing the bark of a diseased tree large blackish spots are seen ; these extend irregularly, but chiefly in a longitudinal direction and on the death of the tree more or less completely surround the trunk. The diseased condition of the wood extends inwards to a variable depth (up to 1 ½ inches). It does not necessarily extend completely round the trunk at a given height, but extends for the whole length of the tree in the form of irregular spots which collectively extend round the circumference of the trunk. Further examination of the surface of a stripped tree during the early stages of the attack (*i.e.* on the yellowing of the leaves) shows the presence of small galleries produced by insects and corresponding to the position of the spots. These insects attack healthy vigorous trees independently of the fungus, and they are always present on diseased cacao plants, even during the last stages of the disease.

If a diseased tree is left in a damp shady place for a few days the characteristic spores of a *Diplodia*, probably *D. cacaoicola*, appear in large quantities on the trunk and branches. Microscopical sections of the black spots show the presence of myriads of hyphae of a brown mycelium to which the black discoloration of the diseased areas is due.

It is more than probable that the above-mentioned insects become infected with the viscid *Diplodia* spores which are so abundant on the dead branches, decomposing fruits and especially refuse pods, and introduce them into their galleries in the bark of the tree, thus causing infection.

To control this disease the writer recommends in the first place that all diseased trees should be cut to the surface of the ground without delay, on the appearance of the first symptoms of the disease ; then the cut surfaces should be coated with a layer of vegetable tar. Attention should be given to the clearing up of all rubbish, such as dead or useless trees in the plantations. Where it is not practicable to burn the empty cocoa pods they should be buried with lime.

c). *Diseases of the branches.* — Canker disease is caused by the punctures of *Sahlbergella singularis* (Hemiptera). " Red rust " is due to an alga, *Cephaleuros virescens*, which causes the premature fall of most of the leaves, and is especially prevalent in situations exposed to the sun. There are also other less serious diseases of the branches and leaves.

d). *Diseases of the fruits.* — There are several different kinds of rot caused by *Phytophthora Faberi*, *Diplodia cacaoicola*, or an undetermined *Colletotrichum* : the latter fungus develops more rapidly on fruits attacked by *Sahlbergella singularis*.

1073 – **Damage caused by *Marssonia Rosae*, in the Roseries near Lyons.** — CHIFFLOT, in *Comptes Rendus hebdomadaires des Séances de l'Académie des Sciences*, 1914, 2nd Half-year, Vol. 159, No. 4, pp. 336-338. Paris, 1914.

As a result of observations of rose gardens in the Lyons district, valuable contributions to our knowledge of *Marssonia Rosae* (Bon.) Br. et Cav. (Melanconiaceae) have been obtained, and it has been realised that this fungus is a more serious pest than was formerly believed.

Not only is the leaf-blade liable to attack as early as June, but also the petiole, stipules and stem are liable to be attacked by the fungus. Further, the disease appears towards the end of September on the flowers, beginning at the base of the sepals, petals and stamens. Although formerly regarded as a leaf-parasite, this fungus may attack all the aerial organs of the plant, especially in certain less resistant varieties. Further, the mycelium, though generally considered as subcuticular, may penetrate into the parenchyma of the leaves and the woody tissues of the stem. It appears that the mycelium is persistent and that it is possible that budding from infected trees will spread the disease.

Although the fungus is difficult to destroy, it is not impossibe to prevent the attack. Infected leaves should be removed and burnt with all fallen leaves. After pruning, the soil and the branches should be sprayed with either Burgundy or Bordeaux mixture or copper acetate, the latter in the proportion of $^3/_4$ lb. to 1 lb. in 10 gallons of water. The addition of 1 oz. of gelatin previously dissolved in 1 quart of warm water improves the adhesive power of the solution. This treatment has given excellent results near Lyons ; the prevention of defoliation thus obtained is favourable to the ripening of the wood and the formation of fruits.

1074 – **Field Studies on the *Endothia* Canker of Chestnut in New York State.** — RANKIN, W. H., in *Phytopathology*, Vol. 4, No. 4, pp. 233-260, figs. 1-2, plate IX. Baltimore, Md., 1914.

These experiments were conducted in temporary field laboratories located at Highland, New York and Napanoch during 1911-13.

In 1911 the disease was abundantly widespread east of the Hudson river as far north as Albany and made the greatest ravages along the state line between New York and Connecticut. West of the Hudson River the disease had not advanced as far north. In Albany County the disease was only general in the southern part. A few spot infections were found in southern Delaware County along the Delaware and Susquehanna Rivers. One spot infection was found at Masonville, Delaware County, and was destroyed. No infections were known west of this region in 1911.

In 1913 the strip along the Delaware River was found to be abundantly affected where previously only isolated spots were found. The disease does not appear to be spreading as rapidly north as west and no infections were found in Otsego County.

In the inoculation of lenticels, glass rings were fixed to the branches with grafting wax so as to maintain a proper humidity for spore germination on the bark. The enclosed bark was then sprayed with a suspension of ascospores in water and the ring sealed with a coverglass. Eleven such inoculations were made and in no case was infection accomplished, whilst every case of wound inoculation produced cankers.

Attempts to obtain inoculation through natural cracks in the bark were also unsuccessful. It is therefore reasonable to conclude that the fungus is not able to penetrate healthy tissue as single hyphae, but when sufficient dead tissue is present to afford the fungus a chance to form the mycelial fans it invades the living tissues.

Mycelium from pure cultures, bits of affected bark, conidial sporehorns, pycnidia from wood, and conidia and ascospores suspended in water, were all capable of producing infection when introduced into open wounds in the bark.

The fact that infection cannot be obtained in old wounds such as insect tunnels is unexplained as yet. Possibly partial callus development and suberisation of the exposed tissue accounts for it.

As a general rule the primary infection of healthy trees takes place in the smaller branches and usually in limbs towards the top or outside of the crown where they are more or less exposed.

Numerous inoculation experiments have shown that two and three year old branches remain susceptible to the disease throughout their growing period, whilst first year shoots are immune during the spring and are only exposed to infection during the summer.

No infection is possible through the midribs of the leaves. No difference in susceptibility between young and old bark was noticeable, except in the case of the present year's growth during the spring, nor was any seasonal variation observed in the degree of suceptibility. Cessation of the growth of the mycelium in the bark during winter, as well as negative results of inoculation at this time of the year, is explained purely on the basis that the temperature is too low for the vegetative activity of the fungus. The healthiest and most vigorous trees are as susceptible as the slow growing, half-dead or otherwise injured trees. Drought and cold do not appear to affect the tree's resistance to the disease and there does not appear to be any relation between the water content of the bark and the rate of growth of the mycelium. Such variations as occur may be explained by other environmental factors, mainly temperature.

Of morphological interest is the development of a form of pycnidium without stroma which is often found on the wood beneath the loosened bark and on the cut ends of stumps and logs.

Other morphological characters of the fungus and the ejection of spores are also dealt with.

1075 – **Two New Wood-destroying Fungi: *Fomes putearius* and *Trametes setosus*.** — WEIR, JAMES R., in *Journal of Agricultural Research*, Vol. II, No. 2, pp. 163-167, plates IX-X. Washington, D. C., 1914.

The writers gives the systematic description of two new Polyporaceae *Fomes putearius* and *Trametes setosus*. The former is closely related to *Fomes conchatus* (Pers.), which is always found on the wood of deciduous trees, especially oaks and willows (*Salix* spp.), and which has not yet been reported on wood of conifers nor been collected in the West. Several collections at hand from southern Germany are all on the wood of broad leaved trees. *Fomes putearius*, on the other hand, always occurs on coniferous wood: *Pinus ponderosa*, *Pseudotsuga taxifolia*, *Picea Engelmanni* with a preference for larch (*Larix* spp.). The rot produced is one of the most conspicuous found in the northwestern forests and is similar to that produced by *Trametes pini* Fries., but the reduction of lignin is on a much greater scale. The fungus was first collected in the Kaniksu National Forest, near Priest River, Idaho. It is distributed throughout the Northwest and is most abundant in the white pine zone.

Trametes setosus is chiefly parasitic on *Pinus monticola* and occurs occasionally on the wood of other trees, but always on conifers. *Polyporus gilvus* Fr., which seems to be the nearest relative and is usually found on the wood of deciduous trees, has not been collected in the West. *T. setosus*, on account of its abundance, causes serious damage to fallen merchantable timber in forest-fire areas. The chemical action of the mycelium on the wood is to reduce the lignin principally in the spring wood, leaving a cellulose ring alternating with sound autumn wood, which causes the annual rings to separate. It was also first obtained in the above-mentioned forest of Idaho and it is distributed throughout the white pine (*Pinus monticola*) belt of the Northwest; specimens have been collected in all the principal forest areas from Vancouver, B. C., to Montana.

INSECT PESTS.

GENERALITIES

1076 – **The Life Cycle of *Sitona lineata* in Germany.** — MOLZ, E., and SCHRÖDER, D., in *Zeitschrift für wissenschaftliche Insektenbiologie*, Vol. X, Part 8-9, pp. 273-275. Berlin-Schöneberg, 1914.

The pea-weevil (*Sitona lineata* L.), which is recorded as particularly injurious in England, should also be classed among the dangerous insects in Germany.

During 1913 the Experimental Station for plant diseases at Halle received notification of 14 occurrences of the insect causing damage by devouring the edges of leaves of leguminous crops; seven outbreaks were on peas, two on beans, two on lucerne, and one each on haricot beans, vetches and clover. One case was also recorded on chicory.

The writers have observed the larvae towards the end of April and the adults towards the end of May. In the open, according to information received, the adults appear in April and May as well as in July and August.

t appears therefore that the beetle is double-brooded in Germany as in England.

In order to reduce the damage in the larval stage which occurs on chicory and beets in April, it is advisable to sow later in districts liable to attacks. Since the larvae begin to pupate at the end of April and beginning of May the larval stage will be almost completed before the plants appear. It is also desirable to make a thicker seeding in the infested areas.

1077 – **The Preparation of Lime-Sulphur Solution.** — *The Agricultural Gazette of Tasmania*, Vol. XXII, No. 7, pp. 255-257. Hobart, 1914.

The Sub-Committee on Fruit-Culture of the Department of Agriculture of Tasmania, after careful examination, recommends the following formula for concentrated lime-sulphur solution (in parts by weight): 50 pure lime, 100 pure sulphur, 500 water. (1) They also recommend dilutions of 1 in 7 (about 14 per cent.) for winter spraying of fruit-trees, 1 in 28 (about 3½ per cent.) for summer spraying of deciduous trees, and 1 in 20 (5 per cent.) for citrus trees (2).

MEANS OF PREVENTION AND CONTROL

1078 – **The Practical Efficiency of Food Traps in the Control of Vine Moths (*Conchylis ambiguella* and *Polychrosis botrana*), and the Presence of the Vine Pyralid (*Oenophthira pilleriana*) in Piedmont.** (3) — Topi, M., in *Rendiconti delle sedute della Reale Accademia dei Lincei, Classe di scienze fisiche, matematiche e naturali*, 1914, 2nd Half-year, Vol. XXIII, Part I, pp. 15-18. Rome, 1914.

Attempts to catch the moths of *Conchylis* and *Polychrosis* in the spring time by means of vessels containing a fermenting sugary liquid made at Alice Bel Colle (prov. Alessandria), had met with little success. The writer therefore repeated his experiments in the summer from July 9 to August 5, placing earthenware vessels containing fermenting liquids at each of the four corners of a vineyard of about an acre in area surrounded by other vineyards; water was added every few days to the pots to make up the loss from evaporation.

At the end of this period 10 *Conchylis*, 73 *Polychrosis* and many other insects, including 2 *Oenophthira*, were caught in the liquid. This method does not appear to be favourable to trapping the last-named moth, which would probably be more attracted by lamp-traps.

From July 18 to August 11 F. Monticelli experimented with two vessels, one containing strong vinegar diluted with water and the other sweet wine equally diluted; he placed them beside a large vine growing on the espalier system against a wall in the town. All the moths captured belonged to *Polychrosis*; 7 were caught in the vinegar and 20 in the sweet wine. A large number of Hymenoptera were drowned in the liquids, most being in the vinegar.

(1) This is the same as the formula recommended by the Citrus-growing Station of Acireale (Sicily): see No. 753, *B.* April 1912. (*Ed.*).

(2) Cf. No. 753, *B.* April 1912; No. 1245, *B.* Aug. 1912; and No. 317, *B.* April 1913.

(3) See also No. 969, *B.* Oct. 1914. (*Ed.*).

This and recent experiments made in France show that liquids with alcoholic fermentation are the most suitable for the capture of the moths. Considering the small number of insects captured in a district with a large area under vines and the large number of food traps and the expense required to carry out the method effectively, as well as the fact that good results can only be obtained by cooperation of all the growers, the writer does not recommend this as a practical means of control. It is, however, valuable as an indicator of the most suitable time to commence operations with insecticides against the larvae.

In studying the development of the broods, thin active larvae of *Polychrosis* 8 to 9 mm. long and stumpy lazy larvae of *Conchylis* of the same length were found during the beginning of June. The vine was in full flower in the middle of June. As is well known the summer pupation takes place in the most diverse places; the pupae are however, rarely found in the places preferred as a winter refuge, but more frequently in the bunches and in leaves spun up by *Oenophthira*. At the beginning of July, the first adults of the second brood are on the wing; all the adults collected, belonging chiefly to *Polychrosis*, were males; it is therefore certain that in this species the males appear before the females.

Large numbers of larvae of *Oenophthira* were noticed in certain places near Alice Bel Colle, though the damage up to the present has not been very important. This is attributed to the abundance of parasites, especially Tachinids, but it is possible that the moth may become very injurious in certain years.

INSECTS INJURIOUS TO VARIOUS CROPS

1079 – ***Euxesta chavannei* and its Relation to the Sugar Cane Disease caused by *Bacillus Sacchari*, in the Province of Tucuman, Argentine.** — BRÈTHES, JEAN, in *Bulletin de la Société entomologique de France*, 1914, No. 2, pp. 87-88, 1 fig. Paris, 1914.

This article contains a description of the new species *Euxesta chavannei* (Diptera), which, according to the collector M. JEAN CHAVANNE, causes the decomposition of the young shoots of the sugar cane and prepares the way for the entrance of the disease known as " polvillo " caused by *Bacillus Sacchari* Speg.

This species is allied to *E. acuta* Hend. and *E. argentina* Brèthes.

1080 – ***Sahlbergella singularis* and other Pests on Cacao in the Mayumbe, Belgian Congo.** (1) — MAYNÉ, R., and VERMOESEN in *Bulletin Agricole du Congo Belge*, Vol. V, No. 2, pp. 261-281, figs. 110-116. Brussels, 1914.

Sahlbergella singularis Hagl. is the most active and most dangerous pest in cacao plantations in the Mayumbe. It appears in abundance twice a year, *viz.* at the beginning of the rainy season (October-November) and towards the end of this period (April-May). There are also other less numerous broods throughout the rainy season.

This insect is most active at night and the effects of its punctures vary according to the organ attacked. In the case of fruits a small vitreous-look-

(1) See also No. 1072, *B.* Nov. 1914. (*Ed.*).

ing dark green spot appears immediately after the insect has made the puncture ; this spot then becomes surrounded by an opaque border of a brownish red colour, which gradually spreads over the spot ; the surface then becomes depressed, and as the spot develops the edges take on a pale orange colour, while the centre turns black.

The damaged tissues grow more slowly than the surrounding healthy tissue, producing cracks, which are soon invaded by fungi or insects, which may produce complete rotting of the fruit or cankers.

On the green branches the spots are at first like those on the fruits ; in general they are elongated and much depressed ; frequently the tip of the shoot dies.

On the lignified branches the punctures develop into longitudinal fissures, which become more numerous as the branch grows and expose the woody vessels. These wounds may soon heal of themselves, or they may extend round the branch owing to successive attacks of the insect or to the intervention of other insects or fungi.

If the attack is serious, the trees gradually lose their leaves and also the greater part of their lateral branches. Sometimes even the larger branches dry up completely.

Other Hemiptera causing similar cankers are : *Helopeltis* sp. (on the fruits and rarely on the twigs) ; *Atelocera serrata* Westw. (common on the twigs) and two undetermined species (rarely on the fruits).

The fungi which cause the rotting of wounded fruits are : *Phytophthora Faberi* Maubl. (at present rare), *Colletotrichum incarnatum* Zimm. and *Diplodia cacaoicola* ; on decomposing fruits two species of *Nectria* have also been observed, one allied to *N. Bainii* Massee, with *Fusarium* sp., etc. The following have been found on the branches: *Diplodia, Colletotrichum* sp., various undetermined Ascomycetes, and besides *Fusarium* sp. other Hyphomycetes, one of which probably belongs to the genus *Tubercularia*.

A combined wash of Bordeaux mixture and petroleum emulsion is recommended for the control of *Sahlbergella* and the other insects and fungi. The wounds should be dressed with vegetable tar, since coal-tar causes a prolonged sterility of the branches. Burning of twigs, branches and dead bushes lying in the plantations is also recommended.

1081 – **Insects injurious to Tobacco in Hawaii.** — Fullaway, D. T., in *Hawaii Agricultural Experiment Station, Bulletin* No. 34, pp. 20 + 9 figs. Washington, 1914.

An account of the principal insect pests of tobacco in Hawaii with reference to their distribution, biology, habits, means of control, natural and artificial, etc.

I. Insects attacking the plant.

a) Caradrina reclusa is the most common of the " cutworms " in these islands and is known locally as " peelua ". This moth was probably introduced a short time ago from Fiji and is now one of the most injurious pests. It is often necessary to replant the crop six or seven times, in spite of the general distribution of poisoned baits and hand picking. Much of the difficulty of the control of the insect is due to the rocky nature of the soil, making it difficult to work. After thorough cultivation of

the soil, the best artificial means of control consists in the spread of poisoned baits amongst the plants (white arsenic or Paris green mixed with moistened and sweetened bran, flour, or middlings). The edges of fields adjacent to uncultivated land are often trenched, so as to present a steep surface on the exposed side which the cutworm cannot climb. Handpicking is sometimes resorted to, but is altogether too slow and expensive. Amongst their natural parasites are : *Frontina archippivora, Chaetogaedia monticola, Ichneumon koebelei, Trichogramma pretiosa* (1) and several birds, which should be protected and increased in number by importation.

b) *Phthorimaea operculella* (2) , or common Gelechiid moth, was first noticed in Hawaii in 1892. The grub (tobacco splitworm) mines the leaves of its host plants, making a broad, flat track through the mesophyll between the upper and lower epidermis, which often becomes badly split and shattered when dry.

It is most injurious to seed-bed plants and considerably retards their growth, so that sturdy seedlings for transplanting are difficult to obtain. This trouble is partly overcome by seeding the beds very thinly and protecting them with cotton netting. The damage on well-conducted plantations is generally confined to the two or three poor soiled lower leaves. In neglected plantations however the disease becomes general.

The grubs can be destroyed by dusting arsenate of lead on the plants in the seed-bed when they are emerging through the epidermis to form new burrows. The arsenic may also be applied as a spray combined with Bordeaux mixture. Under field conditions this treatment is of little value and very expensive. As a precaution against general infestation no solanaceous plants should be grown near the tobacco fields and all solanaceous weeds in the immediate vicinity should be periodically destroyed. The most common parasites of this pest are *Chelonus blackburni* and *Limnerium blackburni.*

c) *Heliothis obsolcta* (3), the tobacco pod-borer, or cotton boll-worm, injures the tobacco plant chiefly by boring the seed pods and to some extent devouring the foliage. In Hawaii it is never found on either corn or cotton and is not generally considered a serious pest of tobacco. It is held in check by topping the plants as soon as the flowers appear, and when seed is desired the flower stalks are enclosed in a bag. Neglected fields always show signs of the borer and if for any reason a field of standing tobacco is abandoned, the plants should be ploughed up and destroyed to avoid a general infestation. The eggs of this moth are probably parasitised by *Trichogramma pretiosa*, though it is not recorded as being actually bred from *Heliothis* eggs in Hawaii. It is possible that it is also attacked by the common tachinid parasites.

d) *Phlegethontius quinquemaculata* (4), or hornworm, is extremely

(1) See also No. 438, *B.* April 1913.

(2) See also No. 1117, *B.* July 1912.

(3) See also No. 2584, *B.* Aug.-Sept.-Oct. 1911 ; No. 627, *B.* June 1913 and No. 1117, *B.* Sept. 1913. (*Ed.*).

(4) See also No. 1118, *B.* Sept. 1913. (*Ed.*).

uncommon and has never been seen by the writer on cultivated tobacco. It is sometimes found near Honolulu on the wild tobacco (*Nicotiana glauca*), which it soon defoliates.

If it were to appear in tobacco fields it could be checked by spraying with lead arsenate (3 lbs. to 100 gallons of water), to which the young larvae are very susceptible. Large worms should be hand picked, as it is difficult to kill them with a stomach poison. Its natural enemies are not known, but there is probably an egg parasite.

e) *Epitrix parvula*, or tobacco flea-beetle, is of recent introduction into Hawaii. Both larvae and adults cause damage, especially the latter, by piercing holes and breaking up the margins of the leaves. It is more common and injurious in neglected plantations, especially in the neighbourhood of other solanaceous plants.

In growing tobacco commercially it is necessary to exercise care and allow no plants to remain after the tobacco has been picked. Other solanaceous crops and weeds in the neighbourhood should be periodically destroyed. When the insect causes damage the affected plants may be sprayed with arsenate of lead, 1 lb. to 20 gallons of water, or half this strength if the arsenate is in paste form.

f) *Minor pests :* the larvae of *Plusia chalcites* and *Amorbia emigratella ; Pseudococcus citri* and *P. virgatus ; Siphanta acuta* and *Pulvinaria psidii ; Elimaea appendiculata* and *Xiphidium varipenne ; Nysius delectus* and *Xyleborus* sp.

II. Insects affecting the stored product.

Lasioderma serricorne, or cigarette beetle, is very injurious and was first observed in Hawaii in 1885. It is generally destroyed by fumigation with carbon disulphide or hydrocyanic-acid gas. This method gives admirable success where the infestation is only incidental and local and the infested material can be placed in a tight compartment so that the full strength of the gases can be utilised. When the infestation becomes general, as in warehouses in which stored products are being continually handled, it is exceedingly difficult to control the beetle. The only means is a systematic fumigation of the whole warehouse from time to time, or different parts of it which can be rendered tight against the diffusion of the gas. It is sometimes a distinct advantage to spray the walls and floors with benzine or kerosene. Manufactured goods are often kept in cold storage to prevent beetle injury, and if not removed too soon the danger of injury after withdrawal is greatly reduced. It has, however, been shown that even low temperatures continued for long periods are not sufficient to destroy the vitality of the eggs. A species of *Pteromalus* has been obtained as a natural parasite of this beetle.

1082 – **Peach Tip Moth injurious to Peaches and other Fruit Trees in New South Wales.** — FROGGATT, WALTER W., in *The Agricultural Gazette of New South Wales*, Vol. XXV, Part 5, pp. 413-414, 3 plates. Sydney, 1914.

Four or five years ago it was noticed in the suburban gardens and in many orchards between Sydney and the mountainous region, that the ends of young branches of peaches and nectarines were attacked by certain small

larvae which pierced one side of the shoots and bored a cavity inside towards the base, causing the drying up of the leaves and the exudation of gum at the tip of the damaged shoot. Sometimes all the branches of the tree were damaged in this manner and an otherwise healthy tree would show tufts of dead leaves at the ends of its branches.

Later developments showed large quantities of the fruits with numerous pustules covered with a gummy secretion under which insects had destroyed the epidermis.

Examination of a few specimens showed the damage to be due to a larva of a small *Tortrix*, which has not yet been identified, but which resembles the codlin moth (*Carpocapsa pomonella*) in its larval and adult forms. The damage to the surface of the fruit is more serious than that to the branches, since large scars are formed on the unripe fruits, which then become unfit for sale.

After describing the life-history, the writer mentions that the larvae cause considerable damage in the neighbourhood of Sydney, not only to peaches, but also to other fruits such as apples and quinces.

As a protection, the peaches should be thoroughly sprayed with arsenate of lead at the beginning of summer and after the appearance of the first damage. In gardens and small orchards straw-banding the trees is recommended.

1083 – **The "Leaf Case Moth" (*Hyalarcta hübneri*) injurious to Fruit Trees in Victoria.** — FRENCH, C. (Junr.), in *The Journal of the Department of Agriculture of Victoria, Australia*, Vol. XII, Part 5, pp. 294-297. Melbourne, 1914.

The "Leaf-Case Moth" has recently been recorded as doing considerable damage to apples, quinces, vines, etc.

The larva has the habit of detaching portions from different fruits, thus rendering a large quantity unserviceable. It also eats the epidermis of the leaves, giving the tree a scorched appearance. The grubs appear to have a distinct preference for the young buds, and since as many as 50 may be present on one tree the damage is considerable. Native trees such as the "tea tree" (*Leptospermum*), eucalyptus and even imported plants (pines and cypress) are attacked with avidity by the pest, though it appears to prefer fruit trees.

The larvae adorn their exterior protective sheath with portions of the leaves upon which they are feeding. If a half-grown larva is transferred to another tree it changes its old covering of leaves for the new leaves.

Another closely allied species, *H. nigrescens* Doubl. (ribbed case or bag moth) causes damage to eucalyptus, but it has not yet been found on fruit trees.

H. hübneri is easily destroyed by means of spraying with arsenate of lead.

1084 – **Insect Pests of Citrus in Ceylon.** — RUTHERFORD, A., in *The Tropical Agriculturist*, Vol. XLIII, No. 1, pp. 49-50. Colombo, July 1914.

The leaf-miner (*Phyllocnistis citrella*) is described in detail. The caterpillar of this Tineid moth mines underneath the upper or the lower epi-

dermis of the young leaves, thus causing them to curl up. The mines also occur underneath the epidermis of the young twigs. The mine often begins near the midrib, runs towards the base of the leaf, where it takes one or two turns, runs alongside the margin and takes one or two turns and then approaches close to where it began. The course of the mine is marked out by a narrow band of brownish frass and the mine itself has a silvery appearance. Not infrequently 4 or 5 caterpillars may be present in a single leaf.

The caterpillars are subject to the attack of small, black Chalcids, which, however, are unable to keep them in check. Were the attack noticed early enough a spraying with tobaco extract might do some good. But it is usually finished before the casual observer's attention is drawn to it. The citrus grower should make himself acquainted with the first symptoms and be on the look out for them.

Sometimes the folded leaves are subsequently tenanted by mealy bugs (*Pseudococcus* sp.), which continue the injury ; but these are less injurious in Ceylon than in many other countries. Here, they are attacked by various enemies, the two chief being the caterpillar of the Lycoenid, *Spalgis epius* West., and a Cecidomyiid (*Diadiplosis coccidivora* Felt.).

A moth very similar to that of the leaf-miner was reared by the writer from leaves of *Melia Azedarach*, but the pupa showed several points of difference.

Other insects that have been observed or recorded recently as doing more or less damage to citrus trees in Ceylon are :

1) *Walkeriana* sp. This large coccid encrusts the stem and branches and is heavily parasitised by an Agromyzid, *Cryptochaetum curtipenne* Knab. The scale is attended by a species of *Cremastogaster*, but the ants do not succeed in deterring the *Cryptochaetum*. 2) *Coccus viridis* Green, or " green bug ". 3) *Lepidosaphes beckii* Newm. infests the fruits and leaves, causing the latter to crumple. 4) *Toxoptera* sp.. an aphis found occasionally on young shoots, but not sufficiently numerous to cause damage. 5) *Tetranychus mytilaspidis* Riley ; a mite closely resembling this occurs on the leaves, causing them to become yellow. 6) *Apogonia comosa* Kav., Melolonthid beetle reported as eating the leaves.

Occasionally, from fruit that has fallen prematurely, small bright-eyed flies emerge. These are Drosophilids, whose habit is to lay their eggs in fermenting material. The fruit falls from some other cause and the flies probably infest it as it lies on the ground.

1085 – ***Otiorrhyncus sulcatus* attacking Vines in the Ile d'Oléron, France.** — RIGOTARD, MARCEL, in *Journal d'Agriculture pratique*, 1914, Vol. II, No. 29, p. 94. Paris, 1914.

The vines in the Ile d'Oléron have been attacked by *Otiorrhynchus sulcatus* F., which appeared for the first time in 1913. The centre of infection is in the communes of Saint-Pierre, Saint-Georges, Dolus and Le Château.

The adult weevil devours the buds and shoots of the vines and the larva feeds on the roots of this and other plants (strawberry, raspberry,

peach, etc.). The damaged roots may succumb to their injuries, and the shoots whose tips are repeatedly damaged are short and knotty and cannot be pruned properly.

Of the various methods of control, the simplest and most efficacious consists in collecting the adults in traps consisting of tufts of grass, moss or dried leaves, exposed at the base of the vines and inspected daily. A local syndicate collected as many as 90 lbs. of insects in two weeks by this method, and it requires about 7 000 insects to weigh 1 lb.

pil

ALFREDO RUGGERI, *gerente responsabile*.

FIRST PART.

ORIGINAL ARTICLES

The Forests of Chile.

by

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Of the 185 939 400 acres which constitute the whole area of Chile, 38 907 750 acres are covered with forest. The distribution of the forests is very irregular and is made clearer by dividing them into the following six forest regions:

Region I. — From the northern frontier of the Republic as far as Taltal, including the provinces Tacna, Tarapaca and Antofagasta, of which only from 0.01 to 0.03 per cent of the area (in all 52 000 acres) is wooded. The forests are composed of *Prosopis Tamarugo, Cordia decandra* and other less important species.

Region II. — From Taltal to the river Choapa; this includes the provinces Atacama and Coquimbo, of which only from 0.3 to 2.5 per cent (in all 226 600 acres) consists of forests. The trees here are *Gourliea decorticans, Caesalpinia brevifolia, Porlieria hygrometrica*, etc.

Region III. — From the river Choapa and to the south as far as the Maule. This district includes the provinces Aconcagua, Valparaiso, Santiago, O'Higgins, Colchagua, Curico and Taltal, with a total of 1 732 000 acres of forest; in the first four the forest area does not exceed 5 to 8.5 per cent, while in the last three it may amount to 12 or even 17 per cent. The forests of the first group of provinces contain only *Acacia Cavenia, Bellota Miersii, Quillaja saponaria, Maytenus Boaria, Litrea caustica, Boldoa fragrans, Cryptocarpa Peumus, Drimys Winteri, Prosopis Siliquastrum* and other secondary species, while in those of the three last we already encounter *Nothofagus macrocarpa, N. obliqua* and *N. Dombeyi, Gevuina Avellana, Kageneckia oblonga* and *Libocedrus chilensis*, with other less important species.

Region IV. — From the river Maule to the river Valdivia, including the provinces Linares, Maule, Ñuble, Concepcion, Arauco, Bio-Bio, Malleco, Cautin and a large portion of Valdivia, with a total of 5 700 000 acres of forest ; the percentage reaches from 17.5 to 35.5. The abundance of forests increases in the following order : Valdivia, Bio-Bio, Malleco, Ñuble. As far as the river Bio-Bio, the exploitable timber is furnished by the following species : *Acacia Cavenia, Quillaja saponaria, Maytenus Boaria, Litrea caustica, Boldoa fragrans, Cryptocarpa Peumus, Drimys Winteri, Nothofagus obliqua, N. Dombeyi, Gevuina Avellana, Persea Lingue;* in the south of Bio-Bio, *Acacia Cavenia* and *Quillaja saponaria* are absent, while in addition are found : *Lomatia dentata, Myrceugenia apiculata, Podocarpus andina, Prumnopitys elegans, Araucaria imbricata, Nothofagus procera, Laurelia aromatica, Myrceugenia Luma, Nothofagus Pumilio, Libocedrus tetragona, Myrceugenia Temu, Myrceugenia multiflora,* and other less important species.

Region V. — This extends from the river Valdivia to the peninsula Taitao, including the provinces Valdivia (southern part), Chiloé and Llanguihue, with a total of 11 145 000 acres of forest (40 per cent of the whole area of the region). This region is already outside the range of *Araucaria imbricata, Nothofagus procera* and *Laurelia aromatica,* while *Nothofagus obliqua, Maytenus Boaria, Libocedrus chilensis, Nothofagus Dombeyi, Persea Lingue* and *Podocarpus andina* are not found beyond the Chacao canal ; on the other hand the following begin : *Embothrium coccineum, Caldcluvia paniculata, Weinmannia trichosperma, Sophora tetraptera, Myrceugenia Meli, M. planipes, Tepualia stipularis, Maytenus magellanica, Nothofagus nitida, N. betuloides, Libocedrus tetragona, Fitzroya patagonica, Lauretia serrata, Eucryphia cordifolia, Podocarpus chilina, Lomatia ferruginea* and other species in small numbers,

Region VI. — This comprises all the territory of Magellan as far as Tierra del Fuego, and has some 20 million acres of forest, or about 30 per cent of its area. These forests consist of the trees mentioned as occurring south of the Chacao canal, with the exception of *Nothofagus nitida* and *Lomatia dentata,* but gradually the number of all the trees decreases till there remain only *Nothofagus betuloides* and *Maytenus magellanica* and some species of *Myrceugenia* as stunted shrubs.

From the area of 38 million acres classed as forest, must be deducted : 8 908 200 acres used as pasture, 18 576 950 acres which produce firewood only, and 6 092 180 acres which only supply stakes and small wood ; there therefore remain only 5 002 110 acres which can be exploited for large timber.

A very important fact which merits consideration also is that of these 38 million acres covered with forest, 20 million acres are upon agricultural land, about 7 ½ million acres are under forest that is beginning to grow, or are pasture, or of uncertain classification and only 11 400 000 acres are on true forest land. On the other hand, nearly 10 million acres of true forest land which were formerly wooded are now completely cleared, the greater part being eroded and worn into gullies by rain, so that it will

soon come under the category of waste land. The immoderate deforestation practised for the purpose of obtaining fuel, and the irrational system of cultivating steep slopes liable to slip under the influence of heavy rains, explain the present existence of 153 000 acres of dunes and the want of water for irrigation, drinking purposes, etc., which prevails in the spring and autumn.

The exploitation of the existing forests requires means of transport, *viz.* alteration of river courses, construction of roads and a thorough system of railways. Only concerns with abundance of capital (which latter is lacking in our country) could undertake such operations, all the more as the State does not possess the necessary funds to carry out the work at its own expense. Wealthy foreign capitalists are therefore required in Chile, where they will find an extensive and lucrative field for the development of their trade.

Generally wood in Chile is sold green as soon as it has been felled; it is badly worked, or hastily piled up, so that it arrives on the market warped, cracked and out of shape.

There are only a few firms which have drying apparatus and it is necessary to encourage and increase such plant, in order that the wood may be exported in the best condition possible. The consumption of the country is not sufficient to absorb the enormous amount which should be produced by the forests in the next few years. The export of wood should be based upon transport by sailing ships, which is more economical than transport by steamers, all the more, seeing that at present there are no means of lowering steam freights, which are very high, amounting to from 30 to 35 shillings per cubic metre (35 cu. ft.) from Chile to Europe.

The two first forest regions were exclusively engaged in importing, but they are now beginning to export pods of *Prosopis Siliquastrum*, which contain from 35 to 50 per cent. of tannin; they give a tawny yellow colour to leather and render it supple. *Cordia decandra*, already rather a rare tree, yields a yellowish brown wood with pretty black markings and is used for ornamental veneering. The wood of *Porlieria hygrometrica* can be used for engraving.

The third forest region also has to import wood; it furnishes the bark of *Quillaja saponaria*, which contains from 15 to 25 per cent of saponin and is largely exported. For furniture making are used the wood of *Bellota Miersii*, *Maytenus Boaria* and *Drymis Winteri*, while the wood of *Prosopis Siliquastrum* is used by the cabinet-maker and enlayer; it resembles that of *Cordia decandra*, but is already very rare. *Acacia Cavenia* might be used for ornamental purposes, but is generally burnt for charcoal or used as firewood or by the wheelwright; the same applies to the wood of *Litrea caustica* and *Prosopis Siliquastrum*. The leaves of *Boldoa fragrans*, and its extract, the well-known *boldoina*, a remedy for diseases of the liver, the urinal and digestive systems and also for internal parasites, should be important articles of export. The present stock of *Nothofagus obliqua*, *N. macrocarpa* and *Libocedrus* no longer suffices for the most pressing needs of the district.

The fourth forest region, in its part to the north of the river Bio-Bio, only exports *Quillaja saponaria* bark, for it does not produce sufficient wood for cabinet-making even to supply its own requirements, and is obliged to obtain it from the provinces south of this river. These, which are usually called " La Frontera ", possess the richest forests of the Republic.

In the first place we may mention as growing there : *Nothofagus obliqua*, yielding a dark red wood, hard and heavy, which lasts for 25 years and more in the ground, and is more resistant than that of most pines and is much used for beams, planks, wharves and piles.

Nothofagus Dombeyi, when its heartwood is of a dark red colour, shot with pale reddish or greenish hues, is as durable as *N. obliqua* and a little harder ; in the trade the two timbers are confused. The pink *Nothofagus Dombeyi* does not last long, while the white form, which covers large tracts of country, could, owing to its low price, be used advantageously in the chemical manufacture of cellulose, but its lack of durability renders it of doubtful value in the mechanical process where cylinders are used.

The wood of *Nothofagus procera*, which is dark red with a slight violet reflection, is a little less hard than that of *N. obliqua* ; it is durable, easy to work and polish, does not break and is the material most used in the interiors of houses. On account of its good qualities, it is difficult to find a substitute. Doors, furniture and windows of this wood last indefinitely; it is also much used for small casks for ordinary wines and in cooperage generally. It is perhaps the best wood for the above-mentioned purposes.

The wood of *Laurelia aromatica* is of an ashy yellow colour, sometimes with dark spots or lines ; it warps and is not very durable in damp, but is much used, and with good results, for the interiors of houses and for furniture.

Persea Lingue wood is reddish, pinkish, or yellowish, sometimes with pretty dark rays. It is heavy, hard, elastic and fibrous and adapted to all purposes. As it retains dyes well, this product is used in the imitation of " nogal ", " caoba ", etc., and is with good reason much appreciated in the country.

The wood of *Podocarpus andina* is of a lemon-yellow colour, less hard and more supple than the preceding products, and is used in the interior of houses both by the joiner and the carpenter. It is not very plentiful.

Libocedrus wood is yellowish white with pale brown rays, a little reddish in the centre ; it is supple, elastic, fibrous, perfumed, does not decay and is used for all kinds of building, furniture, carpentry, beams, posts, props, etc. It is much appreciated in the country, but difficult to exploit, because it grows on slopes far from all means of transport.

Myrceugenia Luma yields a dark red, heavy, very hard, elastic wood, which does not decay and is most suitable for wheelwright's and carpenter's work, especially in the making of poles, wheel spokes, stakes, etc.

The wood of *Araucaria imbricata* is whitish, a little yellowish, supple, hard and durable ; it is employed for all kinds of structures, furniture, posts, and even beams, but as the tree grows on the summits of distant

mountains it has only lately begun to be exploited. The seeds of this tree serve as an article of food for the peasantry during much of the year.

The following would be very valuable woods for furniture, veneers, flooring, etc., both in Chile and abroad: *Gevuina Avellana*, *Lomatia dentata*, *Prumnopitys elegans* and *Drimys Winteri*; but, on account of the fashion of using foreign products, these will not be appreciated at home as they should, until the appreciation of the exported timber shows that we have not rightly valued our national riches.

The barks of *Persea Lingue* and of *Drimys Winteri* are decidedly important, and might be even more so; these are richest in tannin (15 to 30 per cent) when they are thinnest, and are stripped from the trees at the end of winter or in early spring. This bark is the best adapted for tanning leather for soles.

The fifth forest region, in spite of its abundant forests, imports some timber of *Nothofagus obliqua*, *N. procera* and *Persea Lingue* from the fourth region, as well as *Weinmannia trichosperma*, *Caldcluvia paniculata*, *Sophora tetraptera*, *Myrceugenia Meli*, *Tepualia stipularis*, *Eucryphia cordifolia* and *Laurelia*. The other species are not yet well enough studied and known, and are of less industrial importance.

The wood of *Fitzroya patagonica* is light red or reddish brown; it is very elastic and soft, but firm, fibrous and almost without knots; it does not decay, is easy to cut, and does not warp or split. It is used for all kinds of work: furniture-making, carpentry, cooperage, musical instruments, packing-cases, and especially for building in the south, as well as for sheds, partitions and roofs; it is also exported abroad, This wood is much appreciated, but cannot be sufficiently exploited on account of the difficulties of transporting the giant trees from their habitat in the high mountains.

Libocedrus tetragona and *Podocarpus andina* of the south replace by the quality of their wood the similar species which are found further north.

Nothofagus nitidus and *N. betuloides* cannot in the same way replace *N. obliqua* of La Frontera, with which they have nothing in common but their popular name, for their wood rots, splits, warps and spoils. In the same way, *Laurelia serrata* cannot replace the Frontera "laurel", for, in addition to other defects, it is less durable and has a strong smell.

The wood of *Eucryphia cordifolia* is dark reddish, hard, heavy, resistant, does not decay in water, but rots when in contact with the soil. It is used in houses for carpentry, joinery, cabinet-making; also, with varying results, for the piles of quays and for props, stakes, wheelwright's work, etc. The bark of this tree gives a hard leather and contains as much tannic acid as that of *Persea Lingue*, or more.

For flooring and high-class furniture the following woods can be used: *Lomatia ferruginea*, *Embothrium*, *Sophora*, *Tepualia*; as well as others which have been mentioned above, such as *Gevuina*, *Lomatia dentata*, *Drimys*.

Good beams can be made from the wood of *Caldcluvia* and *Weinmannia*, and posts from the latter as well as from *Sophora*, *Myrceugenia Meli* and *Tepualia*; while *Prumnopitys*, *Gevuina*, *Embothrium*, *Myrceugenia*

planipes, M. multiflora and *Maytenus* are used in carpentry, and *Myrce*
genia Meli, Persea and *Sophora* for carts and wheelwright's work; the ra
"curam" more or less replaces *Nothofagus procera* for these purpose
Good charcoal can be obtained from *Myrceugenia Luma, Caldcluvia, Wei*
mannia, Sophora, Myrceugenia Meli, Tepualia and *Eucryphia*; the tw
latter are used by preference for building timber.

All this would be very satisfactory, were it not that the least usef
species are the most plentiful and grow largest, while the most useful a
the rarest and smallest, with the exception of *Myrceugenia Luma* an
M. Meli: these are fairly plentiful and form from 6 to 9 per cent of th
forest trees, while the other species only amount to 0.5 or at most 2 pe
cent of the whole.

The sixth forest region already imports much more timber of *Noth*
fagus obliqua, N. procera and *Persea* than the fifth region, although it figure
as possessing half the forests of the Republic; it also takes from the fift
forest region small quantities of the wood of *Libocedrus, Fitzroya, Wei*
mannia, Caldcluvia, Myrceugenia Meli, Tepualia and other trees, though
possesses the same species; this is owing to the want of means of commun
cation, and to the fact that the trees decrease in size and become mor
irregular as they approach the south and gradually disappear.

There is a large field for exploitation and trade in the native timber tree
which make up about 40 per cent of the forests in Magellan, but it mus
be borne in mind that lack of means of transport, the steepness of the land
the many new species unknown in the wood trade, and the present an
future high freights necessitate that the exploitation of these nationa
riches should be undertaken by large firms.

The study of Chilian timbers shows that there are very few soft, suppl
kinds like *Fitzroya* and *Libocedrus*, but that, on the contrary, hard heav
species abound; further, there is no substitute for oak for making cask
for fine wines. This accounts for the importation, in 1912, of 1 ½ millio
cubic feet of pine wood (chiefly Oregon pine, *Pinus taxifolia*) to the tota
value of £ 160 000, of which 91 per cent came from the United State
and only 9 per cent from Europe. The same thing occurs in the cas
of oak staves, of which 1500 tons, worth £ 8000, are imported, while th
value of the exported wood is only £ 23 000. With good managemen
and administration, the value of these exports might amount to nearly
million sterling, and be a source of considerable revenue to the country

Attempts are being made to supply the want of soft wood in Chile b
planting rows of poplars, but their wood will never adequately repla
deal for general use.

Plantations of pines on a large scale have only been made by son
coal-mine proprietors, as at Lota and Curanilahue, while small plantin
have been made by some of the more progressive landowners. The tre
planted by the State on the dunes of Chanco are a mere drop in the bucke
as far as the present needs of the country are concerned and afford n
adequate provision for future requirements. Nearly all the plantation
consist of poplars (usually *Populus nigra*), *Pinus insignis* or *Eucalypt*

obulus, as rapid production is preferred to quality, to the exclusion of rees yielding good wood such as: *Pinus canariensis* and *P. maritima*, *ucalyptus diversicolor* and *E. resinifera*, *Cupressus macrocarpa* and *C. to-ulosa*, *Acacia melanoxylon*, *Quercus pedunculata*, *Picea excelsa*, *Pinus onderosa* and *P. mitis*, *Abies*, *Picea*, *Larix*, etc. It would be well worth hile to organise also in Chile syndicates, and national and foreign societies ell provided with capital, which could turn their attention to the pre-ervation, good exploitation and re-planting of the forest land of the Re-ublic, taking as a basis the best native species, and at the same time plant-ng such exotic trees as are acclimatised and grow even better in Chile han in their original habitat.

The want of foresight as regards the preservation, exploitation and lantation of forests is such, that any firm undertaking this work on a erious basis, can be assured of the future of its industry, all the more, s no one in the country thinks of future needs, and scarcely even considers resent necessities.

List of the trees mentioned above with their local names.

Acacia Cavenia	espino comun.
Araucaria imbricata	araucaria, piñon.
Bellota Miersii	belloto.
Boldoa fragrans	boldo.
Caesalpina brevifolia	algarrobo.
Caldcluvia paniculata	tiaca.
Cordia decandra	carbon.
Cryptocarya Peumus	peumo.
Drimys Winteri	canelo.
Embothrium coccineum	ciruelillo.
Eucryphia cordifolia	ulmo, muermo.
Fitzroya patagonica	alerce.
Gevuina Avellana	avellano.
Gourliea decorticans	chañar.
Kageneckia obliqua	bollen.
Laurelia aromatica	laurela.
„ *serrata*	huahuan, laurela.
Libocedrus chilensis	cipres.
„ *tetragona*	cipres de Guaitecas.
Litrea caustica	litre
Lomatia dentata	radal.
„ *ferruginea*	huinque.
Maytenus Boaria	maiten.
„ *magellanica*	m. de Magellanes.
Myrceugenia apiculata	arrayan.
„ *Luma*	luma.
„ *Meli*	melí.
„ *multiflora*	pitra.
„ *planipes*	peta.
„ *Temu*	temu.
Nothofagus betuloides	roble de Magellanes.
„ *Dombeyi*	coihue.
„ *macrocarpa*	roble de Colchagua.
„ *nitida*	r. de Chiloé.
„ *obliqua*	roble pellin.
„ *procera*	rauli.
„ *Pumilio*	nirre.
Persea Lingue	lingue.
Podocarpus andina	mañiu.
„ *chilina*	mañiu.
Porlieria hygrometrica	guayacan.
Prosopis Siliquastrum	algarrobo.
„ *Tamarugo*	tamarugo.
Prumnopsitys elegans	lleugue.
Quillaja saponaria	quillai.
Sophora tetraptera	pelù.
Tepualia stipularis	tepù.
Weimannia trichosperma	teñiu.

The Development of the Dairy Industry in Hungary (1).

by

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Of late years the Hungarian dairy industry has altered its aims. Formerly it dealt chiefly with the various methods of utilizing the milk that was produced, whilst at present, without giving up its old principles, it seeks to increase the yield of milk itself.

According to the last census, Hungary possessed 2 800 000 cows which yielded about 808 million gallons of milk; at a price of 5.9 *d* per gallon, this represents a value of £ 19 867 700. For this estimate we have taken as basis the average yield of each of the breeds as shown in Table I.

TABLE I. — *Average yearly yield of the various breeds.*

Breeds	Head	Average yearly yield	
		Per cow, gals.	Total, gals.
Hungarian	630 000	198	124 740 00
Red spotted:			
Simmental & Pinzgau	1 700 000	330	561 000 00
Gray Alpine	90 000	396	35 640 00
Other breeds	290 000	242	70 400 00
Buffaloes	90 000	176	15 840 00
Total	2 800 000	—	807 620 00

In 1913 the value of the exports was as follows :

	£
Milk	443 034
Butter	206 571
Cheese	88 390
Total	797 995

The milk and its products were exported to the following countries: Austria, Bosnia-Herzegovina, Germany, Switzerland, Italy, Netherlands, Rumania, Serbia, Bulgaria, Albania, Greece, Turkey in Europe and in Asia, Egypt, United Kingdom, Russia and United States.

(1) See No. 678, *B.* July 1914 (*Ed.*).

The total exportation of milk, butter, cheese and condensed milk corresponds to 36 029 532 gallons of milk. Comparing these figures with the 807 620 000 gallons of milk produced and mentioned above, it will be seen that our exportation of milk represents 4.46 per cent of the total production.

During the closing years of the nineteenth century there were still many communes in Hungary in which milk could not be disposed of at anything like profitable prices. This fact induced the Ministry of Agriculture to favour the institution of cooperative rural dairies. These were at first rather collecting centres than real dairies, the cream being taken to the central dairies and the skimmed milk sent back to the members. Created by two joint stock companies, the central dairies are under the control of the State, which subventions them. They produce butter of the highest quality, much appreciated at home and abroad. The first central dairy was opened at Temesvár in 1899 and the next year others were founded at Dombrovár, Veszprém and Szabadka.

Three or four years after the organisation of these dairies, a certain number of the cooperative creameries, especially the larger ones, were no longer satisfied with the sale of milk but started the manufacture of butter on their own account. At first this new departure proved very remunerative, especially when, owing to the foot-and-mouth disease and the lack of fodder, the yield of milk diminished considerably, both in Hungary and in the neighbouring countries. Nevertheless the foot-and-mouth disease which raged in 1912 revealed clearly that the recent efforts of the cooperative dairies had not yielded good results.

Since 1906 it has been a constant struggle, every year in one part or another of the country, sometimes against the drought and the shortage of fodder, at other times agaist floods or foot-and-mouth disease. It was natural that these adverse circumstances should lead to an increase in the prices of milk and butter, which in its turn caused the butter from the Hungarian dairies, which until then had been for the most part in demand on the Austrian markets, to be gradually ousted by Danish butter, which was preferred for both its price and its quality. The cooperative dairies suffered great losses and at present a number of them have given up making butter and limit their activity to the collecting and carrying of cream. They have thus led to the creation of three new central butter dairies in three counties. The management of these butter dairies has recognized that in order to improve the quality of Hungarian butter it was necessary to adopt all the measures suggested by the progress in science and technique, and since then the cream has been pasteurized and pure culture starters have been used.

Cooperative dairies do not develop to the extent that would be desirable for the progress of the Hungarian dairy interest. This is to be attributed to the fact that in some parts of the country the small farmer is not convinced of the utility of cooperative dairies. More than once it has happened that small farmers have abandoned the cooperative dairy if in the same commune some dealer has paid a fraction of a penny more for their milk. Still, the commercial spirit of our small farmers is awakening,

and I hope that the principle of cooperation will gradually gain ground among the producers of milk.

As for the production of our cooperative dairies, the following data are available. Since 1897 cooperative dairies have been founded in greater numbers; in that year 34 cooperative dairies with 5937 shares produced 420 759 lbs. of butter; their receipts amounted to £ 22 470. At the end of 1913, 573 cooperative dairies were in full activity; they turned out 4 730 000 lbs. of butter and their total trade amounted to £ 418 150.

The new tendency is to increase the milk yield of our cows, which has been judged insufficient. The average yearly yield of the country corresponds to 308 gals. per cow. Comparing these figures with the results obtained in the States of Western Europe, it must be recognized that there is still much margin for improvement in the production of milk in Hungary. The returns of the dairy industry in the States of Western and Northern Europe are twice as great, in Holland even two and a half times as great, as in our country.

With a view to increasing the production, milk record associations have been organized. The field of their activity is in the county agricultural societies, where they act as sections for cattle breeding or milk recording.

At present milk recording is carried out in 17 societies, in 36 districts, in which 17 000 cows belonging to 635 owners are submitted to methodical control. In one district to which the neighbouring herds are admitted, one inspector records the performance of about 500 cows. The inspectors follow a three months course of instruction in milk control, which is held in one of the dairy schools and to which only pupils who have attended a dairy school of the country and who are aquainted with the practice of dairying are admitted. In each county agricultural society, the section of milk records registers the controlled animals in a local herdbook, and the cows whose yield attains at least 660 gals. during one lactation are also admitted to entry in the national herdbook. In order to defray part of the expenses entailed by the milk control, as well as the salary of the inspector, etc., the societies or control sections receive in the course of three years, a subvention of 2000 crowns (£ 83 6*s* 8*d*) per annum from the Government. The work of the record societies is under the supervision of the Ministry of Agriculture, whose dairy section revises the results sent in by the milk inspectors. The milk record societies held last year their first national conference, at which a proposal was made to found a central milk recording station as soon as milk recording has been instituted in fifty districts. The duty of this station will be to control the work of the sections.

The record associations are very important in Hungary from the point of view of the increase of the production of milk. The experience gained in the country and abroad shows that the average yield of each cow subjected to record increases by 44 gals. during the very first year. Thus, if only 5 per cent of the stock of cows, or 140 000 head, be submitted to systematic control, the surplus of milk will be about 6 173 000 gals., worth £ 151 667. Besides the increase of milk yield systematic and economic

feeding and the keeping of pedigree books, the artificial feeding of calves is also aimed at (1).

Owing to the constantly increasing importation of cheese, efforts have also been made to start cheese factories. Nevertheless as the lack of fodder and the foot-and-mouth disease often hinder the increase of the production of milk, cheese dairying has not yet made much progress. Besides, this branch of the milk industry requires much more experience and technical knowledge and is more risky, than butter making, in which progress is clearly noticeable. The recent increase in the consumption of butter is due to the high prices of lard.

The kinds of cheese made in Hungary are especially Hungarian Emmental, Trappist, Romadour and Magyaróvár, the latter resembling the Tilsit cheese made in the north of Germany. This industry was introduced into Hungary by Swiss cheese-makers who have established themselves in the mountainous parts of the country and make handsome profits. Lately these cheese-makers have established their factories by preference in the western parts of Hungary, because in the South the demand for milk has increased, its price has gone up and turning it into cheese is not remunerative. The Emmental and Gruyère cheeses are for the most part made in the dairies at Répcelak, Bánóc and Nagyszécsény ; the soft dessert cheeses are made at Sárvár, Pusztadör and Kisbér, and most of the Magyaróvár cheese at the cooperative dairies of Moson county.

The number of milk ewes is about three million. (In 1913 the total number of sheep was 6 600 000). Calculating on an average yearly production of 8.8 gals. per ewe, the total yield may be estimated at 26 400 000 gals., which, at 5.45 *d* per gal., are worth £ 600 000. The ewes' milk is used in the manufacture of Brindza or Liptó cheese (2), much esteemed abroad. In 1913, Hungary exported 55 486 cwt., of it, of the value of £ 126 873.

During the last ten years our exportation of milk and milk products has not kept pace with the increase of the production of milk, and this must be due to the increased home consumption of these articles. Only a short time ago, butter, especially in the provincial towns, was used only at dessert, whereas now it has become a popular article of diet.

The greatest consumer of milk is Budapest ; its 900 000 inhabitants consume daily 66 000 gals., or about 0.6 pint per head. In the capital two great firms supply 33 000 gals. per diem ; one, which delivers 26 400 gals., is organised on a cooperative basis; the other, which sells 6 600 gals., is a joint stock company. The farmers send their milk to one of the Budapest railway stations and sell it at 9 *d* and 9 ½ *d* per gal. The public pays 1*s* 2 ½ *d* per gal. for the best milk in bottles delivered at the consumer's house, and 1*s* or 1*s* 1*d* for milk in caus.

For the last three or four years, among the other large cities of Hungary, Temesvár and Nagyvárad have also started municipal dairies ; but as the

(1) See No. 1029, *B.* Nov. 1914. (*Ed.*)
(2) See No. 1669, *B.* Dec. 1912. (*Ed.*)

initial difficulties are not yet overcome, we cannot give exact data on their results.

In Hungary the consumption of milk has considerably increased, especially owing to the anti-alcohol campaign. The daily consumption per inhabitant may be estimated at a little over half a pint ; thus, taking the population of Hungary at 18 ½ millions, the yearly consumption of milk is 446 million gallons, or 55 per cent. of the total amount of cow's milk produced.

Basing our calculations on the available data and taking into consideration the prices of concentrated foods, we have been able to determine the cost of production of milk in this country, which is set forth in the following table :

Cost of production of 1 *gallon of milk.*

Daily yield gals	Corresponding cost d
0.88	9.9
1.10	7.9
1.32	6.6
1.54	5.7
1.76	4.9
1.98	4.4
2.20	5.9
2.42	4.4
2.64	4.9
3.30	4.4

The Control of Plant Diseases in Sweden

by

Prof. JAKOB ERIKSSON, *Stockholm.*

A. — INTRODUCTION.

Many years have elapsed since Sweden began to take measures for the control of plant diseases. The first step in this direction was made in 1876 by the appointment of a Botanist at the Experiment Station for Agricultural Chemistry attached to the Royal Academy of Agriculture and situated at Experimentalfältet near Stockholm. For the appointment of the Botanist the Swedish Riksdag had voted a sum in 1875, and this was renewed for a series of years. The Botanist had the duty of making, during the summer, botanical investigations connected with the experiments carried out by the Station of Chemistry. On December 17, 1876, the writer was named Botanist.

In 1886 a special Botanical Institute, that is to say the Experiment Station for Plant Physiology (Växtfysiologiska Försöksanstalten) was

founded by the side of the Chemical Station. In 1885 the Riksdag had voted the necessary yearly funds for it. The Botanist became the chief of the new station and was entrusted with the drawing up of the detailed regulations and instructions for the 16 State Seed Control Stations, which were approved, the former in 1886, the latter in 1888. The duties of the chief included also the inspection of these Stations during the years 1888 and 1889.

In 1889 there was a disastrous attack of rust on the oats in Sweden: the total crop of the whole country was about 160 000 tons below the average of the preceding ten years. According to a proposal of the chief of the Station, the Academy of Agriculture presented to the Government on January 20, 1890, the request that a sum of £ 550 be voted for new, thorough and extensive investigations into this rust during the years 1890 to 1892. On February 14 the Government granted the sum demanded and the work began immediately. As assistant for this investigation Dr. G. J. Henning was attached to the Station up to April 1894.

On June 22, 1905, the American gooseberry mildew (*Sphaerotheca mors-uvae*) was observed for the first time in a Swedish garden (at Blekinge in the south of Sweden). In a short time the disease spread to several other localities. In investigating the matter it was found that the disease had been introduced by means of gooseberry bushes which had been sent direct some years previously from a Danish nursery. A leaflet was immediately distributed to put farmers on their guard against the parasite. On September 22 the Government enacted a provisional law against the importation of gooseberry plants and fresh gooseberries into Sweden. At the same time the chief of the Station addressed to the Governments of all the countries of Europe in which gooseberries are cultivated, an appeal to put themselves on the defensive against the approach of the enemy. In the course of the following year (1906), the disease having invaded the neighbourhood of Stockholm, further measures were taken. The Government allocated a sum of £ 55 for the control of the fungus. On September 10 of the same year the Government prohibited, until further orders, the transport within the country of gooseberry plants or parts of plants, with the exception of the fruit. By means of articles in a great number of Swedish newspapers the public was warned of the danger that threatened this important crop. The most rapid and efficient measures were recommended for the eradication of the pest. Unfortunately this appeal remained without effect. During the succeeding years the disease spread more and more; at present it is frequent in most of the Swedish gardens. The laws against the importation and transport of gooseberry bushes were repealed in April 1910.

Since 1907 the Botanical Station has formed part of the Central Agricultural Experiment Station (Centralanstalten för försöksväsendet på jordbruksområdet) as Division of Agricultural Botany (Afdelningen för landtbruksbotanik). In 1907 also some changes were made as to the buildings, etc., of the Station. A new piece of land for experiments and a new building were placed at its disposal. Since 1914 the Division

disposes of an annual budget of £ 973 10s. Out of this sum the chief gets £ 410, with a periodical increase of £ 33 for seniority. The assistant receives £ 165, and the laboratory help £ 38 10s. For the experiments £ 357 10 s. are set apart.

On October 2, 1912, potato canker (*Synchytrium endobioticum* or *Chrysophlyctis endobiotica*) was observed in Sweden. Efficient measures were immediately taken to eradicate the disease, and apparently with happy results (1).

On October 1, 1913, I retired, having reached the age limit fixed by the law, and on April 24, 1914, my post was occupied by Mr. E. J. Henning, professor at the Ultuna College of Agriculture. Mr. C. T. V. Hammarlund is at present attached to the Division as assistant.

B. — Work of the Botanical Station at Experimentalfaltet.

a) *Various work.* — During the first years, several experiments of cultures in solutions were made with the object of investigating the influence of certain mineral salts, considered poisonous, on certain plants. But even as early as that some research on plant diseases was made.

At the same period popular pamphlets on various diseases were issued; such were papers on *Nectria ditissima*, on *Exoascus Pruni*, etc.; they were followed by the publication of special studies, for instance in 1879 on *Typhula graminum*, in 1880 on *Sclerotinia Trifolium*, in 1883 on *Cladosporium herbarum*, in 1884 on *Phytophthora infestans*, and in 1885 on *Scolecotrichum graminis*, *Phragmidium subcorticium*, *Sphaerotheca pannosa*, *Uncinula Aceris* and *U. Tulasnii*, *Asteroma radiosum*, *Fusicladium dendriticum* and *F. pirinum*, *Morthiera Mespili* and others. In 1890 a summary of observations made in the course of several years on a great number of the diseases of various plants was published under the title of " Some diseases of cultivated plants and the means of controlling them ".

Since 1890, the presence of parasitic fungi in the samples sent to the Station has been determined, and information as to the nature of the diseases and on the corresponding treatment is forwarded to the senders of the samples. Whilst the number of such samples rarely reached 100 before 1902, it has often been 300 and 400 during recent years. The highest figure was reached in 1907 when the number of reporters was 464 and the number of specimens and questions was 537.

Besides the above work, the officials of the Station have visited the various infected localities of the country to make investigations on the spot and to give farmers information and advice.

b) *Research on the rust of cereals.* — In 1894 and 1895 the first preliminary publications on certain results obtained during the years 1890-1893 appeared. In 1894 : " Principal Results of New Investigations into the Rust of Cereals " (2), and in 1895 : " On the Specialization of Para-

(1) See *B.* July 1913, p. 1006, and No. 18, *B.* Feb. 1914.

(2) According to the wish of the author, the titles of articles published in Swedish are here translated. (*Ed.*).

sitism in Cereal Rusts", "Favourable Influence of Cold on the Germination of the Spores of Certain Fungi", "Is the Rust-resistance of the Various Varieties of Wheat Constant or not?" were published.

A detailed account of the results obtained between the years 1890 and 1893 was published in June 1896 under the title "Die Getreideroste, ihre Geschichte und Natur, sowie Massregeln gegen dieselben". The 1894 Report and the detailed account of 1896 were written by the chief and the assistant of the Station together.

In a series of more or less ample works published successively, after new research, and written by the chief of the station, many subjects connected with the rust of cereals were examined in detail. Among these publications may be mentioned the following: in 1896, "Which are the Grasses which can communicate Rust to Barberries?", "New Research on the Specialisation, Propagation and Origin of Black Rust", and "Barberries Bearing and Propagating Rust"; in 1897, "Further Observations on the Specialisation of Black Rust", "New Observations on the Nature and Propagation of Crowned Rust", "Characteristics of the Brown Rust of Cereals", "On the Duration of the Capacity of Germination of the Winter Spores of Certain Kinds of Rust"; in 1899, "New Studies on the Brown Rust of Cereals"; in 1900 and 1901, "On the Origin and Spread of Cereal Rust by Means of the Seed"; in 1902, "Ist der Timotheengrassrost eine selbständige Rostart oder nicht?," "On the Specialisation of Cereal Black Rust in Sweden and in Other Countries"; in 1903, "On the Vegetative Parts of Yellow Cereal Rust"; in 1904 and 1905, "Ueber das vegetative Leben der Getreiderostpilze", I-IV; in 1905, "Zur Frage der Entstehung und Verbreitung der Rostkrankheiten der Pflanzen"; and in 1908, "Neue Studien über die Specialisierung der grasbewohnenden Kronenrostarten".

With the preliminary communication of 1894 mentioned above, and especially with the detailed report of 1896, the question of the rust of cereals entered upon a new phase.

From that moment it became evident that among the rusts attacking the common cereals (wheat, rye, barley and oats), six different species were to be distinguished, namely: *P. graminis*, *P. glumarum*, *P. dispersa*, *P. triticina*, *P. simplex*, and *P. coronifera*; and for the commonest grasses, the very similar rusts of which had always been regarded as identical with those of cereals, six other species: *P. Phlei-pratensis*, *P. bromina*, *P. agropyrina*, *P. holcina*, *P. Triseti* and *P. coronata*.

In the two above-mentioned publications, the principles of the specialisation of fungi were set forth and discussed. In one and the same species of fungus several different strains may be distinguished; these are distinct from each other from the biological point of view, and are called "specialised forms" (f. sp.): *P. graminis*, for instance, which attacks the four cereals and also a great number of grasses, includes among other forms the f. sp. *Avenae*, living on oats, *Dactylis*, *Alopecurus*, *Milium* and certain other grasses, but incapable of transmission to wheat, rye or barley.

In the full Report mentioned above, the whole life and cycle of evolution of the different kinds of rust, as well as the essentially different degrees of resistance of the various cereals to the various species of rusts, are described in detail.

The greatest care has been bestowed on the study of the hibernation of these fungi and the appearance of new outbreaks of disease on the following year's crop. It was believed that these two questions were completely solved by the existence of winter spores, and that these spores lived unchanged until the following spring, when they germinated and gave rise to new outbreaks of the disease. The new investigations did not, however, support this opinion generally accepted by the learned. The winter spores alone were not sufficient to solve the problem of hibernation. Numerous observations made in the course of several years led me to suspect the existence of an interior germ of the disease in the grain itself or in the young plant grown from it. These suppositions were presented to the public for the first time in the works that appeared between 1897 and 1900, and especially in the memoir " On the Origin and Spread of the Rust of Cereals by means of Seed " (1900-1901).

In these publications the hypothesis was advanced that the fungus was present in the cell of the host in a special state ; that it lived under the form of a plasma, and that it contracted a kind of simbiosis with the protoplasm of the cell. It is this association which has been called " mycoplasm ". At a certain period of development of the host plant, during a certain season, and when external conditions (heat, moisture, light, etc.), are favourable, the mycoplasm abandons its state of plasm, issues from the cell and forms a perfect spore-bearing mycelium giving origin to rust pustules.

In 1902 and 1903 this hypothesis was subjected to a scrupulous examination, in which the new methods of cytological preparation were applied. Dr. G. Tischler, lecturer at the Heidelberg University, took part in these investigations as collaborator during both summers. The results of this cytological investigation were published in a series of memoirs under the title " Ueber das vegetative Leben der Getreiderostpilze ", I-IV (1904-05), in which the phases of the vegetative life of these fungi are described.

It was easy to foresee that a new theory as subversive as this would meet with opposition. This opposition led to answers on my part, published in the memoirs of 1904 and 1905, as well as in several special pamphlets, including the following: in 1903, " The Researches of Professor H. Marshall Ward on the Brown Rust of the Bromes and the Mycoplasm Hypothesis " ; in 1910, " Ueber die Mycoplasmatheorie, ihre Geschichte und ihren Tagestand " ; " F. Zach's cytologische Untersuchungen über die Rostflecken des Getreides und die Mycoplasmatheorie " ; in 1912, " Rostige Getreidekörner und die Ueberwinterung der Pilzspecies " ; and in 1914, " On the Appearance of Rust Spores and Mycelium in the Seeds of Cereals ".

c) *Studies on other kinds of rusts.* — In 1898 a note entitled " Study on *Puccinia Ribis* ", containing the history of the development of this fungus, was published.

In 1896 appeared a pamphlet: "Some Observations on the Vesicular Rust of Weymouth Pine". In this it is shown that the relationship existing between *Peridermium Strobi* and *Cronartium ribicola* is not always sufficient to explain the occurrence of this rust. On both kinds of host plants (*Pinus* and *Ribes*) the fungus can live from one year to another when one of the hosts is absent, or when the distance between them is 20 or 30 miles.

Hollyhock rust (*Puccinia Malvacearum*) has for a length of time been the object of very extensive research; the results are published in two Reports, one of 1911 under the title "Der Malvenrost, seine Verbreitung, Natur und Entwickelungsgeschichte", the other of 1914 bearing the title "Experiments of Immunisation of the Hollyhock against Rust". It appears from the first work that the reappearance of the disease on the new growth cannot be sufficiently explained by the fungus spores. Two forms of spores have been recognized, similar to each other morphologically but having a different way of infecting. The second work shows that the vitality of the fungus living in the latent state in the inside of plants, may be arrested or weakened by introducing a liquid fungicide into the roots of the host plant or by watering the soil in which the hosts live with a weak solution of sulphate of copper.

d) *Studies on other plant diseases.* — During the years 1898-1902 and 1911, a disease attacking several root crops and known under the name of *Rhizoctonia violacea* was studied. The results of these investigations were published in 1903: "Some Studies on *Rhizoctonia violacea* on Carrots", and in 1913: "Studies on the Disease caused by *Rhizoctonia violacea*" (1).

Since 1905 extensive research has been carried out on the American gooseberry mildew (*Sphaerotheca mors-uvae*). The results of these investigations are published in about thirty papers, among which we quote the following: in 1905, "The American Gooseberry Mildew in Sweden", "American Gooseberry Mildew, its Nature, its Propagation, and the Means of Controlling it"; in 1908, "Stachelbeermehltau und Stachelbeerkultur"; in 1909, "Einige Versuche das Winterstadium des amerikanischen Stachelbeermehltaues mit Fungiciden zu töten", "Die verschiedene Empfänglichkeit der Stachelbeersorten im Kampfe gegen den Amerikanischen Stachelbeermehltau".

Two of the most destructive diseases of fruit trees, *Monilia fructigena* and *M. cinerea*, have been the object of continued research (2). We may mention here the publication: "Zur Kenntniss der durch *Monilia*-Pilze hervorgerufenen Blüten- und Zweigdürre unserer Obstbäume".

On another equally destructive enemy of fruit trees, the apple mildew (*Podosphaera leucotricha*), a communication was made in 1908 in the paper: "Der Apfelmehltau und seine Bekämpfung".

A new disease which until then had not been observed, caused by

(1) See No. 426, *B.* April 1913; and *B.* July 1913, p. 1007. (*Ed.*).

(2) See *B.* July 1913, p. 1007. (*Ed.*).

Exosporium Ulmi, was the object of minute investigation during the years 1905 and 1906. The result was published in 1912 in a paper " Ueber *Exosporium Ulmi* n. sp. ".

During recent years several potato diseases have been studied. In 1912 the results of an examination of the felt disease of potatoes (*Hypochnus Solani, Rhizoctonia Solani*) were published in the article " Felt Disease of Potatoes " (1).

In order to ascertain the influence of a solution of formalin spread on the soil in which potatoes grew, on potato canker or black scab (*Synchytrium endobioticum* or *Chrysophlyctis endobiotica*) some special cultures in boxes were organized during the summer of 1913.

In 1912 a summary of the results of research carried out for many years on the diseases of beets was published. This work bears the title " Fungus Diseases on Swedish Beet Crops " (1). A more detailed report of one of the diseases (*Uromyces Betae*) mentioned in the said work, was given in 1914 under the title " Some Studies on Beet Rust ".

A summary of research concerning the diseases of cucumbers (1) was published in 1913 in the work " Fungus Diseases of the Swedish Cucumber Crop ".

In 1910 I published a manual bearing the title " Landtbruksväxternas Svampsjukdomar ". In 1912 an English edition, revised and somewhat enlarged, appeared under the title of " Fungoid Diseases of Agricultural Plants ". A German edition " Die Pilzkrankheiten der landwirtschaftlichen Kulturpflanzen " was published in 1913, and a French edition, " Les maladies cryptogamiques des plantes agricoles et leur traitement ", in 1914.

e) *Efforts for the establishment of international collaboration with a view to controlling the diseases of cultivated plants.* — The idea of such an international collaboration was mooted for the first time in 1890 at the International Congress of Agriculture and Forestry at Vienna. At that time I presented a proposal aiming at an international agreement for the defence against such diseases. A great number of motions all tending to the same aim have been presented since at International Congresses : Paris (1900), Rome (1903 and 1905), Vienna (1907), Rome (1907 and 1908), Montpellier (1908), Rome (1909,1910 and 1911), Paris (1912) and Rome again for the eighth time in 1913.

In view of an efficient control of plant diseases, a Bill was prepared for Sweden in June 1913, and the Swedish Government is having it examined.

But the most important diseases, those which are responsible for at least 90 per cent of the yearly losses, cannot be advantageously controlled by legislative measures. In a Report presented to the International Conference on Phytopathology (held in Rome from February 24 to March 4. 1914) and bearing the title " Phytopathological problems : the different diseases require different measures ", I called attention to this important fact.

(1) See *B.* July 1913, p. 1007. (*Ed.*).

C. — Work of Official Botanical Institutions.

At the Ultuna Agricultural College, near Upsala, prof. Henning has studied some fungi and insects injurious to crops; he has besides given advice and information as to the methods of controlling them and has published works on these subjects.

At the Alnarp College of Agriculture, near Lund, Prof. T. Hedlund has studied several parasitic fungi and especially those of root crops. He has also published reports on the results obtained by his research and he has distributed papers dealing with these subjets among farmers.

In connection with the extensive work for the improvement of seed carried out by the Svalöf Station for Seed Improvement (Sveriges Utsädesförening i Svalöf) several plant diseases have been studied. Reports upon this work have been published by officials attached to the Institution, and especially by Dr. H. Nilsson-Ehle and Dr. H. Tedin.

The State Forest Experiment Institution (Statens Skogsförsöksanstalt i Stockholm) has commenced of late years investigations in forest pathology. Memoirs concerning diseases of conifers and some other species have already been published. These publications are due to the Assistant of the Institution, Dr. G. Lagerberg.

SECOND PART.

ABSTRACTS

AGRICULTURAL INTELLIGENCE

GENERAL INFORMATION.

ORGANIZATION OF EXPERIMENTAL AND ANALYTICAL WORK

1086 – **Report of the Work of the Experiment Stations and Experiment Fields of Annam, 1913.** — DEVRAIGNE, GEORGE (Chef des Services Agricoles et Commerciaux locaux de l'Annam) in *Bulletin économique de l'Indochine*, Year 17, No. 108, pp. 348-363. Hanoi-Haiphong, May-June 1914.

I. — *Experiments with industrial plants.* — The Caravonica variety of cotton was experimented with at the station of Hué. It is a resistant variety and makes good growth, but has the disadvantage that its pods reach maturity during the rainy season. Attempts will be made to remedy this as far as possible by suitable pruning. Kapok from Venezuela was very successful, whilst that from the Malay peninsula and Cambodia was less successful. The oil-yielding *Camelia* (1) was successful at the Yên-dinh Station (north Annam), but it was not a success at the Hué station (South Annam), where the climate is very different. Amongst rubber trees *Ficus elastica* and the liana *Cryptostegia madagascariensis* have succeeded at Hué ; *Funtumia elastica* was less successful and Hevea was a failure. *Arenga saccharifera* succeeded well at Hué and in groups of three the trees resisted the most violent winds and typhoons; it is fairly abundant in the forests of Annam and the fibres are used to a small extent by the natives. Camphor grows exceedingly well at Hué, and Kola nuts, *Merremia mamosa* and *Curcuma longa* were also successful..

II. *Experiments with food plants.* — In 1912 an orchard was established at Hué with native and exotic species, including bananas, shaddock,

(1) Various species of *Camelia* such as *C. drupifera*, *C. Sasanqua*, *C. theifera*, are used for the extraction of oil from the seeds. Cf. WATT, *Dictionary of Economic Products of India*. Calcutta. (*Ed.*).

orange, mangosteen, pineapple, papaya, cacao, pepper, etc. Experiments on the cultivation and selection of rice have been in progress since 1906 at the Yên-dinh Station. The results obtained each year from 1906 to 1913 are summarised in tables by the writer. During the last year (1913, the variety "Lua Chânh", an early hill rice. yielded 1242 lbs. per acre) whilst various selected swamp rices yielded from 1242 to 2737 lbs. per acre.

III. — *Animal breeding.* — At the Hué Station the acclimatisation of a breed of Kélantan sheep from Yên-dinh was very successful. The silkworm egg-breeding stations founded by the Government continue to increase: during 913 they numbered 11 and distributed 636 293 batches of eggs.

CROPS AND CULTIVATION.

1087 – **The Climate of Ethiopia.** — EREDIA, F., and DE CASTRO, L., in *Bollettino della Reale Società Geografica*, Part VIII, pp. 845-884. Rome, 1914. AGRICULTURAL METEOROLOGY

There is little information concerning the climate of the high plateau of Abyssinia, the only data available being those of DOVE obtained in 1890 (Kulturzonen von Nord Abessinien, *Ergänzungsheft Nr. 97 zu Petermanns Mitteilungen*, Gotha, 1890), those published in the *Annales de l'Observatoire physique Central Nicolas*, Petrograd, 1898-1903; those collected by LYONS, etc. All these observations have the disadvantage of having been made during limited and irregular periods.

In October 1901 Dr. L. DE CASTRO established a meteorological station at Addis-Abeba, where he began a series of regular observations which, together with Dr. E. ODDONE, he continued until 1911. The data thus obtained have been examined by Prof. FILIPPO EREDIA and summarised in the accompanying table.

The difference between the highest and lowest mean monthly temperatures (18.7° and 14.6°) is very slight; thus the climate is mild and the mean temperature almost uniform throughout the year. The difference between the day and night temperatures, on the other hand, is very great and averages 15° C. The maximum daily temperatures during the hottest period are almost 35° C. whilst the night temperatures during the coldest months approach zero.

The rainfall shows a very distinct period of abundant rain from the last ten days of June until the second ten days of September, the highest rainfall being during the first ten days of August. This period of intense rain is followed by an interval where the rainfall is less abundant, beginning suddenly and lasting until the end of February. Extreme drought occurs in January, when no rain has ever been recorded during the first ten days. This period is followed by more abundant rains, which increase as the rainy season approaches. The rains may be divided into two classes: the less abundant and prolonged rains during the period of low rainfall and the more abundant short rains during the rainy season. The heavy rains are almost always accompanied by electrical disturbances,

which are particularly frequent in the afternoons. At the same time the wind is generally from the S or SW, whilst the storms come from the N or NE and sometimes from the E. The heavy rains should therefore be attributed to opposing currents of air, whilst light rains may be considered as entirely of orographical origin.

During the rainy season the predominant winds are N, W and NW.

Summary of the Climatological Data of Ethiopia.

(*Temperatures in deg. C., rainfall in mm.*)

Month.	Mean temperature				Extreme temperature		Rainfall		Fine days.	Relative humidity	Direction of predominant wind
	daily	max.	min.	range	max.	min.	quantity	No. of rainy days.			
January	15.5	24.2	6.8	17.4	28.0	3.0	12.5	3.8	22	53	SE
February	17.0	25.3	8.6	16.6	30.0	3.5	33.1	2.9	20	54	SE-E
March	18.3	26.3	10.3	16.0	29.5	5.0	67.7	9.7	15	67	SE
April	18.0	25.6	10.4	15.2	32.0	6.0	75.4	12.0	11	70	SE-E
May	18.7	26.7	10.7	15.8	33.0	4.0	75.9	9.1	15	58	E
June	17.7	25.3	9.9	15.4	34.0	7.0	128.9	20.9	8	73	SE
July	16.6	23.0	10.3	12.7	31.0	7.0	266.1	28.3	2	78	N
August	16.2	22.1	10.1	12.0	29.0	7.0	316.4	28.6	2	87	N
September	16.5	23.1	9.8	13.3	38.0	6.5	188.3	23.2	7	85	SE
October	16.6	24.8	8.4	16.4	33.0	4.0	18.2	3.9	20	63	E
November	15.0	23.3	6.8	16.5	27.5	1.5	21.3	2.5	23	53	E
December	14.6	23.1	6.0	17.1	28.0	0.0	8.8	2.2	24	48	E
Year	16.7	24.4	9.0	15.4	38.0	0.0	1 212.6	148.1	169	66	SE-

There is also a distinct daily variation; in the mornings the E and S E winds predominate, changing to the N in the evening. The end of the period of heavy rains is marked by the predominance of N E and E winds, those of the S W and S disappearing almost completely.

The seasons are described as follows:

Winter (October, November, December): low temperature; little rain; high variation daily; minimum relative humidity; large number of fine days; prevailing wind E.

Spring (January, February): mild temperature; relative lack of rainfall; high daily variation; minimum relative humidity; large number of fine days; predominant wind: S E.

Summer (March, April, May, June): high temperature; relatively abundant rain; average daily variation; average relative humidity; few fine days; predominant wind S E.

Autumn (July, August, September): mild temperature; abundant rain; minimum daily variation; high relative humidity; very few fine days; predominant winds; N and S E.

The natives divide the seasons according to their rainfall, the four seasons in the above order being known as Tebbi, Hagai, Todi and Kerempt.

1088 – **The Estimation of Phosphates in Soil Extracts.** — PRESCOTT, J. A. (Rothamsted Experimental Station) in *The Journal of Agricultural Science*, Vol. VI, Part 2, pp. 111-120. Cambridge, May 1914.

SOIL PHYSICS, CHEMISTRY AND MICROBIOLOGY

The method of estimating phosphates recommended by the United States Division of Chemistry, which consists in dissolving the phosphomolybdate precipitate in excess of standard alkali and titrating back with standard acid, was examined with regard to certain working conditions. It was shown that it is essential to avoid working at too high a temperature, 55° C. proving most favourable. The presence of silica also proved a disturbing factor and this substance should be precipitated in the preliminary phases of the estimation. Determinations made with solutions containing known amounts of phosphate yielded results 3 per cent too high when the calculations were based on the usual factor (1 cc. $^{N}/_{10}$ alkali = 0.0003088 gm. P_2O_5) and it is therefore recommended that the factor 1 cc. $^{N}/_{10}$ alkali = 0.0003004 be adopted, as it corresponds approximately to the constitution $48\,MoO_3 . 2P_2O_5 . 5\,(NH_4)_2O$ for the yellow precipitate.

Another method of estimating small quantities of phosphate was tried; it consists in converting the phospho-molybdate precipitate into lead molybdate and weighing it as such; it was found to be no more accurate than the titration method, while being less rapid.

1089 – **Azotobacter in Connection with Nitrification.** — HEADDEN, W. P. (Colorado Experiment Station) in *Science*, Vol. XL, No. 1028, pp. 379-381. Garrison, N. Y., September 11, 1914.

In certain pure cultures of *Azotobacter*, brown pigmentation was obtained; this tended to weaken and disappear in the successive generations. Where such pigmentation occurred a decided reaction was obtained with phenolsulphonic acid apparently indicating the presence of nitrates and consequently a power of nitrification on the part of *Azotobacter*. On further investigation, however, it was found that the colour reaction was due to the pigmentation and not to the presence of nitrates, thus destroying all evidence of nitrifying power on the part of *Azotobacter*.

1090 – **Overhead Watering Plant.** — DEAN, WILLIAM HARPER, in *The Country Gentleman*, Vol. LXXIX, No. 31, pp. 1309-1311. Philadelphia, August 1, 1914.

PERMANENT IMPROVEMENTS, DRAINAGE AND IRRIGATION

Among the many systems of irrigation, the overhead system presents several advantages, namely that it can be used on sloping uneven ground where surface irrigation would be difficult to apply, that it can be used to distribute liquid manures, and that sprays for the control of plant diseases and injurious insects can be applied easily, evenly and efficiently.

The writer, in company with the U. S. Government irrigation engineer in charge of irrigation investigations in the States east of the Mississippi,

visited some farms irrigated on this system and reports upon two among the most successful of them.

The first is situated in Central New Jersey. It is a farm in which 9 acres are irrigated by this system and 19 by surface irrigation; most of the land is under strawberries and orchards. The water is pumped up from a river by a 24 HP. gazoline engine. The pumping plant, pump house and connection to the mains carrying water to the fields cost $778. The rest of the irrigation plant for the first five acres cost, in 1910, $1162 distributed as follows:

Pipe materials all galvanised	$ 852
Freight on pipes and incidentals	25
Patented fittings	143
Posts for spray lines	52
Day labour at $ 1.25 per day	50
Plumber at $ 3 per day	40
	$ 1 162

The second part of the installation for the next 4 acres cost $1438.

From the pumping plant a 5-inch galvanized steel main carries water under 30 or 40 lbs. pressure to the overhead pipes. These pipe lines are 425 feet long and 50 ft. apart, supported every 40 ft. by upright steel pipes. In order to ensure the same pressure throughout, the diameter of the pipes varies from 1 ½ inch to ¾ inch.

By a slight turn of a lever the whole length of these pipes may be turned to change the angle of the tiny spray nozzles that are situated four feet apart in each pipe; roller bearings on each line make this possible. During irrigation the angle of these nozzles has to be changed seven times to get the rain evenly distributed over the space between the lines.

This system supplies 40 gals. a minute to the acre; it would put an inch of water on the land in about 12 hours.

The second farm visited is situated in Southern New Jersey; it covers 35 acres, 10 of which under overhead irrigation. The land is level and the soil a light, poor sand.

The water is pumped up from a creek by a 12 HP. gazoline engine and is distributed at 20 lbs. pressure. The overhead lines are 250 feet long and 50 ft. apart. The supports are 20 ft. wooden posts 125 ft. apart: from the tops of these poles were stretched cables from which are suspended the spray pipes by means of other wires. Twelve gallons a minute is the output through the nozzles for the first half of each spray line, and half of this for the second half, at which rate an inch of rainfall can be put on in 12 hours.

The average cost of the plant is $250 per acre. Depreciation is very low being chiefly limited to the pump and engine and to the wooden supports for the spray lines.

In this farm concentrated Bordeaux mixtures or Paris green wash pumped into the system of pipes while clear water is running through, and in 20 minutes 1 ½ acres can be sprayed. Liquid manures are applied in the same way.

1091 – **Irrigation Scheme for Sinde; The Development of Cotton.** — SUMMERS, T. (Proceedings of the East-India Association), in *The Asiatic Review*, Vol. V, No. 11, pp. 298-330. London, October 1914.

The low productivity of this large tract of the Indus Valley appears to be due to the low rainfall, which varies from 2 to an average of 6 inches. The soil of the Sind consists of alluvial silt deposited by the Indus, and in former times (about 500 B. C.) its fertility was increased by an excellent irrigation system which enabled it to support a much greater population.

At the present time, a few canals exist only on the lowest tracts, only one-fourth of the area is cultivated, the cultivators lift comparatively silt-less water on to their fields at a cost of 5 rupees or more per acre, and a population of 800 000 persons cultivates only 600 000 acres.

The writer describes a scheme, known as the Rohri Canal Project, which, if carried out, will bring into cultivation between one and two million acres of this fertile land, of which half to three-quarters of a million acres will be suitable for cotton and capable of supporting twenty or thirty cotton mills.

The cost of this scheme is estimated at about 10 millions sterling and at the present rate of assessment the net annual profit to the Government would amount to between ¼ and ½ a million sterling.

1092 – **Experiments in Tilling the Soil by Means of Explosives.** — I. SPRING. F. G. Dynamite Experiment. — *The Agricultural Bulletin of the Federated Malay States* Vol. II, No. 11, pp. 297-299. Singapore, June 1914. — II. DURHAM, HERBERT E. On the Use of Explosives in the Garden, in *The Journal of the Royal Horticultural Society*, Vol. XL, Part I, pp. 7-18. London, August 1914.

TILLAGE AND METHODS OF CULTIVATION.

I. In October, 1913, some experiments were made at the Experimental Plantation, Kuala Lampur (Federated Malay States), on the use of explosives in rubber cultivation. The land on which they were carried out is of a poor laterite nature and the rubber plants were very backward in growth. The results are those hitherto obtained from an area subjected to gelignite charges.

Three parallel rows of rubber, each containing 34 trees, were selected; on one the explosive was used, while the other two were kept as controls. The cartridges were placed at a depth of 2 ½ feet below the surface of the ground, one cartridge between two trees 12 ½ feet apart. The method of firing was by means of fuses and detonators.

The average increase of girth measured on June 9, 1914, was 2.56 inches in the dynamite row and 1.81 and 1.62 in the control rows. The cost of applying the explosive is 15 cents per charge, inclusive of labour. One charge per tree is generally allowed. The results would have been more evident if the subsoil had been of a clay nature, as is the case at Castleton Estate, where an experiment on a much larger scale is being conducted.

II. The writer wished to ascertain whether explosives can be used for loosening the subsoil on small areas, such as gardens intensively cultivated, and near buldings. He used " cheddite " cartridges with 2 oz., 1 ½ oz., 1 oz. and ½ oz., charges placed three feet apart and at a depth of three feet. One piece of the ground had recently been double dug before the exploding

and it was obvious that much of the force which would have been utilized if the ground had not been spaded was wasted.

Compared with the control plot not loosened by cheddite, the potato Crimson Beauty showed that the response to the exploisve was very marked. Thus the ½ oz. charges gave about 15 per cent. increase, the 1 oz., 43 per cent and the 2 oz. about 88 per cent. Cauliflowers and cabbages showed no appreciable difference on exploded and unexploded ground. With peas the number of plants was much smaller on the unexploded side, on which they blossomed and matured a week earlier than on the exploded ground. Carrots, onions and scorzoneras gave a greater number of plants, and germinated and developed much better on the exploded ground ; with the latter plant especially the crop was much increased by the explosive. With asparagus the shoots were not far from having been doubled in length.

As for the cost : at wholesale prices, four or five 2 oz. shots including fuse and detonators can be had for a shilling. With regard to the energy developed by cheddite, allowing 50 per cent loss of the total available energy a 2 oz. charge gives about 50 400 foot-pounds in the soil, that is quite ten times as much energy as would be put into the soil by using the spade to a depth of three feet.

MANURES AND MANURING

1093 – **The Relative Effect of Lime as Oxide and Carbonate on Certain Soils.** — HUTCHINSON, H. B., and MAC LENNAN, K., in *The Journal of Agricultural Science* Vol. VI, Part 3, pp. 302-322, plates IX-X. London, September 29, 1914.

To make a further study of the hitherto not fully known mechanism of the changes wrought by caustic lime in the soil, five soils of widely different type were taken :

1. *Rothamsted soil*, a poor stiff clay containing 7.72 per cent of organic matter (loss on ignition) and 1.94 per cent of CaO.

2. *Chelsea soil*, a black sandy soil containing 14.32 per cent of organic matter and 1.42 per cent of CaO.

3. *Craibstone soil* (Scotland), a light soil, rich in organic matter (14.5 per cent), with 0.41 of CaO.

4. *Millbrook soil* (Woburn), a very light sandy soil, poor in organic matter (4.46 per cent), with 0.26 of CaO.

5. *Woburn soil*, an open sandy loam, which has been rendered distinctly acid by annual applications of sulphate of ammonia for the last 37 years it contains 4.58 per cent of organic matter and 0.56 per cent of CaO.

Laboratory Experiments.— The soils were passed through a 3 mm. sieve and filled into bottles in lots of 900 gms. A set of bottles from each soil was set aside as control, and the others received calcium oxide in the proportion of 0.1, 0.2, 0.3, 0.4, 0.5 and 1.0 per cent, while calcium carbonate was added to another lot to the extent of 1.0 per cent, with the exception of the Craibstone soil, where applications of 0.3, 0.6 and 0.9 per cent of carbonate were made. The water content was made up by means of sterilized water to 18 per cent. A set of bottles was taken immediately after the end of this ten-day treatment, and the others were stored, provided with cotton wool plugs, at room temperature. The various soils were examined once a month: the number of bacteria was determined, as well as th

amount of ammonia and nitrates produced. Examinations for protozoa were also made.

Pot experiments — The soils were passed through a 3 mm. sieve previous to being filled into glazed earthenware pots (in which loss by drainage was prevented) at the rate of from 8 to 10 kg. of soil per pot. Lime as oxide and carbonate was applied in the same ratio as in the laboratory experiments. The surface soil was then wetted with 100 cc. of water in order to allow of efficient action of the caustic lime before it became carbonated. Ten barley seeds were sown in each pot, and after about a month the plants were thinned out to five per pot. Equal numbers of the seedlings were weighed to ascertain the initial effect of the lime on plant growth.

The results are given in numerous tables and diagrams and are summarized as follows:

Caustic lime is found to have two distinct effects on the soil:

1) A partial sterilisation effect.

1) A chemical action, decomposing some of the soil organic matter.

The amount of caustic lime necessary to induce specific changes in the flora and fauna of the soil depends very largely upon the character of the soil. The light sandy Millbrook soil, poor in organic matter and in carbonate, reacted sharply with 0.2 to 0.3 per cent. caustic lime; the Rothamsted clay soil, poor in organic matter but rich in carbonate, was found to react to 0.3 to 0.4 per cent; the acid Woburn soil required between 0.5 and 1.0 per cent, as did also the rich Chelsea garden soil, which already contained carbonate; the Craibstone soil, with a high organic and a low carbonate content, failed to react even to applications of 1.0 per cent caustic lime.

Each of these soils, as well as many others examined, appears to absorb directly a definite amount of caustic lime, and until these requirements are fully satisfied the partial sterilization phenomena do not set in. These phenomena include a sudden initial decrease and subsequent increase in the numbers of bacteria, the extinction of the larger forms of protozoa and the inhibition of nitrate production. Lower doses than those required for partial sterilisation induce a temporary suspension of nitrification, and consequent accumulation of ammonia, for periods varying with the amount of lime and the character of each soil; they also lead to a temporary increase in numbers of bacteria capable of growing on gelatine plates, but these afterwards decrease, until the level of the untreated soil is reached.

Caustic lime causes chemical breaking down of some of the organic matter of the soil, as shown by the ammonia formed during periods when soil bacteria are quiescent; when, however, bacterial growth commences, there is a large increase in the rate of ammonia production.

The return in nitrogen, as ammonia and nitrate for each increment of lime applied, varies with the character and reaction of the soil and the carbonate content. On the average, and within a period of about 250 days, it amounted approximately to 1.0 per cent by weight of the caustic lime applied. Carbonate gave less returns, apparently because of its relative inaction on soil organic matter.

The pot experiments show amounts of available nitrogen in the soils comparable with the amounts of ammonia and nitrate produced in the laboratory experiments. In some cases the amount of caustic lime applied was sufficiently large to check the growth of bacteria and to depress plant growth in the first crop, but in the case of the Chelsea soil the bacteria were active but plant growth was depressed, a phenomenon not yet satisfactorily explained.

As in other experiments, inhibition of nitrification resulting from applications of lime leads to a higher nitrogen content in the plants. This has been ascribed to the assimilation of nitrogen compounds other than nitrates, and, if occurring to any extent, involves an uneconomic utilisation of soil nitrogen. Where the amount of lime does not check nitrification, as in the case of the lighter dressings to the Craibstone soil, the nitrogen content of the plants is about the normal.

1094 – **The Duration of the Action of Manures.** — HALL, A. D., in *The Journal of the Royal Agricultural Society of England*, Vol. LXXIV, pp. 119-126. London, 1913.

A set of experiments was started at Rothamsted in 1904 in order to obtain practical information on the duration of action of manures. It took the following form : for each manure five plots were set aside ; one was a check plot which at no time received the manure under investigation ; of the other plots, one received the manure in 1904, but remained unmanured in 1905, 1906 and 1907 ; a second plot was manured in 1905, but not in 1906 and 1907 ; the third in 1906, but not in 1907 ; the fourth in 1907. Thus in 1907, by which year the experiment was in full swing, there was a plot that had been manured in that year, another that had been manured in the previous year, a third two years previously, and a fourth three years previously. In 1908 it was considered that the manure applied in 1904 to the first plot had been exhausted by the four crops grown with it, and the manure was renewed on that plot ; on the second plot it was renewed in 1909, and so on. The field was farmed on a rotation of alternating corn and roots and contained eight sets of five plots as follows :

Nitrogenous manures :

1. Dung made from roots and hay only.
2. Cake-fed dung.
3. Shoddy (wool waste).
4. Peruvian guano.
5. Rape dust.

Phosphatic manures :

6. Bone meal.
7. Superphosphate.
8. Basic slag.

Once during each rotation a dressing of superphosphate and sulphate of potash was applied equally to all the nitrogen plots ; similarly for the corn crops a dressing of sulphate of ammonia was given alike to all the phosphatic plots. The unmanured plot in each series was so placed in the line that together they formed two diagonals across the field and the mean

of the first five was used for comparison in the case of nitrogenous manures, the mean of the last three as the standard for the phosphatic plots.

The results are considered under three headings.

1. *Residual values of rich and poor dung.* (1) — In the year of application, the cake-fed dung showed a great superiority over the roots and hay dung, but this superiority was much less manifest the second year and entirely disappeared the third and fourth year, though the effect of the dung persisted in both cases, raising the yield above that of the unmanured plot. These results are due to the fact that both kinds of dung contain approximately the same amount of insoluble nitrogen, while the cake-fed dung is richer in ammonia and amides, the effect of which had completely disappeared after the second crop.

2. *Other nitrogenous manures.* — The relative total produce of the other three nitrogenous manures is given below, the unmanured plot in each case being taken as 100.

	Year of application — Mean of 9	1 year old residue — Mean of 8	2 year old residue — Mean of 7	3 year old residue — Mean of
Shoddy	139.7	125.2	116.1	106.7
Peruvian Guano	150	101	96.5	94.4
Rape dust	136.2	100.4	100	94.4

A marked contrast exists between the shoddy on the one hand and Peruvian guano and rape dust on the other. The shoddy evidently contains compounds of nitogen subject to comparatively slow decay, so that its effect in the second and succeeding years is considerable, there being a distinct increase indicated in the fourth crop grown with the manure. Indeed, the values yielded by shoddy compare very closely with those obtained with farmyard manure made from roots and hay only. It is a persistent manure that exerts in the first year of application less than one-half of its total effect. Doubtless we should include in the same category all manures made from hair, fur, skin, silk, hoofs, horns, etc ; and probably also the nitrogen compounds of bones.

Very different are the results yielded by Peruvian guano and rape dust. For both these manures the return in the first season is high ; they are well-known as active and effective nitrogenous fertilizers ; but the experiments show that they leave no residue possessing any value for succeeding crops. Owing to the limited number of experiments, too much stress cannot be laid on the actual figures obtained, but it may be concluded that the nitrogenous residue from Peruvian guano or rape cake after a crop has been taken will give less than 10 per cent. increase in the second crop, and after that

(1) See No. 15, *B.* Jan. 1914.

will be completely exhausted. (It should be noted that this statement applies to the nitrogenous part only of these manures, not to the phosphates they contain). Now the nitrogen compounds in question are, in the gnano, ammonium compounds, uric acid and its derivatives, and some proteins ; in the rape cake, almost entirely proteins ; and it is a point of great importance in this connection thus to find that proteins are as active and as temporary in their action as ammonium compounds. Such a result is indeed intelligible, for the true proteins are readily and completely digestible, are equally easily attacked by bacteria, and pass thereby into ammonia and kindred bodies with great rapidity. There is other evidence from the Rothamsted experiments that the nitrogen in rape cake is, pound for pound, very nearly as immediately effective as the nitroegn in ammonium salts. The proteins thus fall into line with nitrates, ammonia, urea, etc., as compounds which produce all their effect in the season of their application, and leave little appreciable residue behind, in contrast to the collagens (the insoluble nitrogen compounds of wool, skin, bone, etc.) and to the indigestible residues of food. With this distinction in mind, the residual value of the nitrogen in other fertilizers can be roughly estimated : in cakes and seed residues it will be present in the form of protein : in fish guanos, it wll be mainly protein ; in meat guanos, protein and collagen, the latter predominating the poorer the manure becomes and the more it approximates to bone meal. Though these conclusions are based on experiments on the Rothamsted soil alone, it is one that would usually be considered retentive of manure, being both heavy and cool, fairly supplied with rain but not waterlogged.

3. *The phosphatic fertilizers.* — The following table shows the relative total produce yielded by the three phosphatic fertilizers, the unmanured plot in each case being again taken as 100.

	Year of application — Mean of 9	1 year old residue — Mean of 8	2 year old residue — Mean of 7	3 year old residue — Mean of 6
Superphosphate	116.2	109.1	113.8	107.8
Bone meal	114.6	112.4	109.1	105.6
Basic slag	114.5	110.5	104.8	112.0

These results are significant in two directions : 1) that the phosphatic manures persist in the soil, and the residues exert an effect roughly proportional to the amount of phosphate unused ; 2) that superphosphate is as lasting a manure as either bone meal or basic slag. These conclusions are perhaps limited to a soil like that of Rothamsted reasonably well furnished with carbonate of lime, so that the compounds formed in the soil by the soluble phosphoric acid will be mainly those containing lime. With regard to the original object of these experiments, it is clear that the

compensation to be paid for a dressing of phosphatic manure must be spread over a longer period than that given for most kinds of nitrogenous fertilizers.

Phosphatic manures are usually applied in considerable quantity; with the ordinary dressings it may be assumed that at least one-half of the original value of the manure remains in the soil after the first crop has been taken, and compensation to that extent should be given to the outgoing tenant, always assuming that the soil is one needing phosphatic fertilizers, so that the original expenditure was justified. When phosphatic fertilizers are used on suitable grass land, the scale of compensation should be even higher and should last for more than four years, because of the cumulative change wrought in the herbage as well as the actual phosphoric acid left behind.

1095 – **Prohibition of Collection of Guano in the Ballestas Islands, Peru.** — *La Riqueza Agricola*, Vol. IV, No. 27, pp. 161-163. Lima, Peru, 1914.

Owing to the steadily increasing consumption of manures in the development of Peruvian Agriculture, it has been necessary to restrict the exportations of guano from the country (1).

In 1890 the Peruvian Corporation obtained the rights of exploiting the existing deposits, but later deposits were reserved to the native cultivation. As the demand for guano increased in Peru, owing either to the exhaustion of the soil in cultivation or to the extension of the area of land under cultivation or to the adoption of more intensive methods, or to the better education of the rural classes, the simultaneous exploitation of the guano deposits presented great difficulties, since the agricultural interests, which had insufficient command of labour, were injured by the Peruvian Corporation which extracted the largest quantity of guano with the highest percentage of nitrogen. As a result of this, by decree of the 25th February 1909 (promulgated for that particular year but which remained in force until 1914) the guano deposits were divided into two zones: north of Callao for the "Peruvian Coorporation" and south of Callao for the country requirements, except the Ballestas Islands and Lomita Point, which were included in the first zone. This decree however did not remedy the unfair distribution of the product, to the detriment of the agricultural community, as shown in the following table.

This table shows that the Peruvian Corporation extracted six times the quantity of guano obtained for the agricultural community of the country.

Consequently a new Government decree of February 5, 1914 declared the deposits of the Ballestas Islands to be reserved for the three years, after which period they are to be worked for the benefit of the farmers.

This is considered to be the first step towards supplying the needs

(1) See *B.* February 1914, No. 107. — Also: International Institute of Agriculture. *Production et Consommation des engrais chimiques dans le monde.* 2nd Editon, 1914. (*Ed.*)

Yield of Guano from the different zones.

Year	by the Peruvian Corporation		for the farmers of the country
	Ballestas Islands	Total	
	tons	tons	tons
1909	5 342	23 236	2 708
1910	6 650	24 403	4 109
1911	7 700	22 377	3 168
1912	4 272	16 865	4 176
	23 964	86 881	14 161

of agriculture in Peru with all the guano it requires, as is contemplated by art. 21a of the contract cancelling the external debt of 1890, which granted the right of exportation to the Peruvian Corporation.

1096 – **Recent Inoculation Experiments on Virgin Sphagnum-Moor Soils, with Various Cultures of Bacteria of Leguminosae.** — Von Feilitzen and Nyström in *Journal für Landwirtschaft*, Vol. 62, Part 3, pp. 282-283. Berlin, October 1, 1914.

The writers conducted at the Swedish Moor Experiment Station at Jönköping comparative inoculation experiments with inoculated earth, with earth cultures of Kühn's Nitragin, with earth cultures of Simon's Azotogen, and with Earp-Thomas' American Farmogerm. The experiments were carried out in a greenhouse in unglazed stoneware pots, each of which was filled with 33 lbs. of virgin undecomposed sphagnum peat fresh from the pit, all precautions having been taken to prevent any infection by contact.

For every special inoculation, five parallel pots had been prepared and manured at the rate of 4460 lbs. of slaked lime, 357 lbs. of superphosphate, and 357 lbs. of 38 per cent. potash salts per acre.

The plants grown were yellow lupins. The seeds were sterilized by being steeped for 5 minutes in 90 per cent. alcohol and then dried aseptically. The lupins developed quite normally and yielded the following amounts of green stuff per pot :

Not inoculated	347	gram
Inoculated with inoculated soil	541	»
» » Nitragin	583	»
» » Azotogen	601	»

The effect of inoculation was thus very marked, and the yield of lupins was nearly doubled. On the average, Azotogen gave the best, while Farmogerm gave the smallest results. The difference between the first three substances was so small, that considering also the differences in the parallel pots, it is not possible at present to give the preference to one rather than to another.

The examination of the roots showed that Farmogerm had caused much less abundant formation of nodules than the other substances employed.

1097 – **The Consumption of Fertilisers in South China.** — CARLETON, A. E. (Vice Consul General, Hongkong), in *Daily Consular and Trade Reports*, Year 17, No. 214, p. 1404. Washington, September 1914.

The consumption of manures, both natural and chemical, in China has not materially increased in the last few years, but the prospects are rather in favour of an improvement for the future. A large amount of money has been spent already in demonstrating the advantages to be derived from the use of proper manures, and many farmers in the delta of Canton and elsewhere have been supplied with fertilisers free of charge in order that they might see for themselves the efficacy of modern methods.

A considerable trade in bird manure has developed in Canton and the neighbourhood, and it is estimated at about $ 175 000 per annum. This class of manure is sold at about $ 1.75 per picul of 133 1/3 pounds.

A considerable amount of natural manure is exported to China from Macao (Portuguese Colony), the total trade in 1912 being over $ 80 000. To these manures must be added a certain per cent of bean cake which comes from North China. The trade of Chilian nitrate of soda is on the increase, although the total imports into Hongkong amounted last year to only about 1 500 tons. This manure costs c. i. f. Hongkong about $ 50 per ton. This high price has restricted its use to market gardening purposes and for manuring mulberry trees. The Chinese Government treats nitrate of soda as dangerous goods like gunpowder and it is necessary to obtain a permit from the central government for its importation.

The duty on nitrate is about $ 0.17 per 100 lbs. Sulphate of ammonia comes chiefly from England and Germany, and the importations amount to about 1500 tons per year; the c. i. f. price Hongkong is about $ 4.25 per picul. This fertiliser is used mostly for rice but in a very small way, as the price is prohibitive for the Chinese farmers. A very little guano is imported from islands in the Pacific. It is said that a Chinese company intends to work the deposits in Pratas Islands. Most of the phosphate output of Christmas Island goes to Australia and that of Ocean Island to Japan.

The total value of manures, including chemical manures, imported into China during 1912, was $ 503 205 and in 1913 $ 700 872 (1).

1098 – **Fractional Analysis of Wheat.** — BARBIERI, N. A., in *Comptes Rendus hebdomadaires des Séances de l'Académie des Sciences*, Vol. 159, No. 7, pp. 431-434. Paris, August 17, 1914.

By the successive action of various neutral solvents on 44 lbs. of wheat (*T. turgidum*) ten distinct fractions including the ash were obtained.

1st *Fraction:* Washing with distilled water; the slightly coloured solution is concentrated on a water bath after filtration; on treatment with chloroform the mixture separates into two layers, an aqueous solution above and a chloroformed solution below.

(1) See: The International Movement of Fertilizers. *B.* Sept. 1914. (*Ed.*).

2nd *Fraction*: *Maceration.* — The washed grains remain for 15 hours in chloroformed distilled water; they are then stirred and filtered. This highly coloured solution, is concentrated on a water bath and treated with chloroform, when it separates into two layers as above.

3rd *Fraction: Extraction with hot water* (at 50°-60° C.) so as to soften the completely macerated grains, without breaking the periderm. The solution is concentrated on a water-bath and precipitated by means of strong alcohol, the precipitate being separated by filtration.

4th *Fraction: Extraction with boiling water.* — The softened grains are boiled for one hour, causing them to swell and break. The liquid is then filtered through a porcelain filter, concentrated on a water bath and precipitated by means of strong alcohol, the precipitate being separated by filtration.

5th *Fraction*: *Sifting.* — The swollen grains are sifted and treated with strong alcohol, which dehydrates and disintegrates them into a white homogeneous finely granular mass, which has the appearance of a meal without bran, obtained by coagulation with alcohol without mechanical means. This meal is separated from the alcoholic liquor by filtration.

6th *Fraction*: *Pericarps and germs* —. The two epidermal layers and the germ remaining behind on the sieve are extracted with strong alcohol and filtered.

7th *Fraction*: *Chloroformed solution.* -- The preceding solutions in water and alcohol are mixed and distilled until free from alcohol. The residual aqueous solution is concentrated on a water-bath, filtered and treated with chloroform. The two layers thus formed are separated by decantation. The lower chloroform solution is mixed with the preceding chloroform solutions and distilled. The residue is extracted with ether, the solution filtered and the ether distilled. The residue is then extracted with absolute alcohol, the solution is filtered and evaporated in vacuo to dryness, leaving about 2 gm. of a yellow colouring matter known provisionally as *bleine*, which is probably a physiological transformation product of chlorophyll. It does not give the biuret and acrolein reactions, is insoluble in water, but soluble in benzene, carbon disulphide, petroleum ether, etc.

Alcohol is added to the aqueous solution until a slight cloudiness appears. It is then dialysed and the dialysed liquid is concentrated on a water-bath. On the addition of excess of acetone, two salts, monopotassium phosphate and potassium sulphate, are precipitated and purified by dialysis and reprecipitations.

These salts have been obtained by extraction from wheat grown on land which has not received mineral manures for a considerable time. Analysis of the dialysed salts shows the absence of chlorides and monocalcium phosphate.

8th *Fraction: Ethereal solution.* — The flour, seed-coats and germs, and the first two precipitates free from alcohol, are extracted with ether. The ethereal solutions are filtered together and distilled, leaving 225 gms. of an oily residue, which, when treated with acetone, is separated into two parts, one soluble, the other insoluble; they are separated by decantation.

he insoluble portion consists of 211 gms. of an oil insoluble in alcohol and ee from phosphorus, sulphur, nitrogen and ash, and 6gms. of stearin. The etone-soluble portion contains traces of bleine, palmitin, and oleopalmitin, id traces of phosphates that can be separated by dialysis with ether.

The fact that the total phosphorus of a complete ethereal extract of heat is found only among the products of treatment with acetone and that ie supposed lecithins are insoluble in acetone, would appear to prove the bsence of lecithin from wheat, as previously stated by the writer (*Comptes-endus*, 1st August 1910).

9th and 10th Fractions : Insoluble ash. — 1 kilogram of the flour from the h extraction is well dried and incinerated with 1 kilogram of seed-coats id germs. This ash contains the insoluble salts of the flour, 0.30 per cent, id the insoluble salts of the pericarp and germs, 0.62 per cent. They nsist chiefly of calcium sulphate and tri-calcium phosphate. Carbonates re entirely absent.

Former determinations of the mineral matter of plants were entirely ased on studies of the ash. The amounts of acids and bases were deter-ined and the salts were estimated by calculations from these figures with-ut recognising the many changes induced by the high temperatures during cineration. By means of the methods described above all the soluble lts can be separated by dyalisis and the insoluble ones, which probably ie high temperatures do not affect, by incineration.

99 – **Studies on the Mulberry Leaf.** — I. Chemical composition of mulberry leaves attacked by *Diaspis* and of healthy leaves. — II. Chemical composition of mulberry leaves in the morning and evening. PIGORINI, L., in *L'Italia Sericola*, Year I, No. 5, pp. 1-3; No. 6, pp. 11-12: Milan, September and October 1914.

1. No extensive and systematic researches have been hitherto under-ken with the object of establishing the relation between the chemical mposition of mulberry leaves and yield of silkworms. It is generally lmitted that the chemical composition of the leaf has considerable effect n the quality of the silk, and according to ABDERHALDEN and DEAN the nino-acids are of most importance in this connection.

The leaves chosen for the experiments by Prof. VERNON were very se-ously damaged by *Diaspis*. Control leaves were taken from trees of ie same age but free from the disease owing to severe pruning and the esence of *Prospaltella berlesei*. It should be noted that the leaves were thered in the beginning of June at 8 a. m. during dull weather, seeing at leaves are much richer in substance at the end of the day after exposure sunshine.

The 200 diseased leaves subjected to analysis weighed, without petioles, 0.3 gms. while the 200 healthy control leaves weighed 205.6 gms. The sults of the analysis are shown in the fololwing table :

Table I. — *Compostion of the leaves.*

	Healthy trees	Diseased trees
	per cent	per cent
Water	73.4	68.6
Dry matter at 100° C.	26.6	31.4
100 parts of dry matter at 100° C. contain :		
Ethereal extract	3.41	3.87
Crude fibre	12.78	11.34
Ash	12.70	10.54
Total nitrogen	4.19	3.05
Proteid nitrogen	3.78	3.04
Non-proteid nitrogen	0.41	0.46
Percentage of non-proteid nitrogen in total nitrogen	9.78	13.17
100 parts of the fresh leaves contain :		
Water	73.4	61.6
Dry matter at 100 °C.	26.0	31.4
Ethereal extract	0.9	1.2
Crude fibre	3.4	3.56
Ash	3.37	3.30
Total nitrogen	1.11	1.09
Proteid nitrogen	1.005	0.954
Non-proteid nitrogen	0.109	0.144
Percentage of non proteid nitrogen	9.82	13.21

No general conclusion can be drawn from this analysis as to the great or less value of the diseased mulberry leaves, since no account has been ma of the amounts of sugar, starch and other substances such as pentosans whi can be utilised by the silk worms to a greater or less extent. The followi conclusions however may be drawn :

1) The leaves attacked by the *Diaspis* become thicker, tougher a almost coriaceous and seem therefore less digestible than healthy leaves

2) The low percentage of water is not conducive to their easy dige tion and assimilation.

3) The total nitrogen and protein of the dry matter is considerab less in the diseased leaves.

4) The percentage of fatty matter, on the contrary, is increased.

5) crude fibre is more abundant in the fresh leaves of the diseas plants.

Thus, healthy mulberry leaves have a greater food value than tho diseased, though the differences may not be sufficiently great to justify t rejection of diseased leaves as food for rearing silkworms.

II. — For these experiments leaves were collected on land belongi the Royal Silkworm Station of Padua, at sunset after five days duri which the leaves had had good exposure to sunlight, and at daybreak.

TABLE II. — *Chemical composition of mulberry leaves of the variety Limoncina collected during the first days of September,*

	Morning		Evening	
	Percentage of dry matter	Percentage of fresh matter	Percentage of dry matter	Percentage of fresh matter
ater	—	68.419	—	63.156
ry matter at 100° C. . . .	—	31.581	—	34.844
thereal extract	5.521	1.743	5.443	1.880
otal nitrogen	2.445	0.772	2.534	0.883
roteid nitrogen	2.309	0.729	2.368	0.824
on-proteid nitrogen	0.1105	0.043	0.166	0.059
otal saccharides calculated as glucose	7.326	2.313	8.064	2.810

These results support the following conclusions :

1. The analysis of the leaf distinctly shows the characteristics of autumn aves. The percentage of water is less and the percentage of dry matter greater than during the spring and summer, as seen from KELLNER'S ana- ses and results obtained by the writer on the leaves of healthy mulberries the beginning of June. The greater quantity of substances extracted by her (fat) is in agreement with the results of SCHULZE and SCHÜTZ con- rning the leaves of *Acer Negundo* (Die Stoffwandlungen in den Laub- ättern des Baumes insbesondere in ihren Beziehungen zum herbstlichen lattfall, *Landw. Versuchs-Stationen*, XXI, 313, 1909). In these analyses e ethereal extract of the dry matter was 4.87 per cent one evening during ay and reached 10.86 per cent on the evening of September 6. The de- ease in total nitrogen, proteid nitrogen and non-proteid nitrogen of the utumn leaves compared with spring and summer leaves is very apparent d agrees entirely with the results of KELLNER'S analysis, as well as with ose of SCHULZE and SCHÜTZ.

2. As in the case of other plants, mulberry leaves during the day un- r the action of sunlight increase their quantity of organic matter, including ts and nitrogenous matter, both proteid and non-proteid, as well as carbo- drates. These results are fully confirmed by those of SCHULZE and HÜTZ for the leaves of *Acer Negundo*.

3. Leaves collected at sunset contain more food material than leaves llected in the morning.

It is reasonable to suppose that these differences will be still greater ring the spring and summer.

1100 – **Methods of Estimating Carbohydrates. II. The Estimation of Starch in Pla Material** (1) — DAVIS, W. A., and DAISH, A. J. (Rothamsted Experimental Stati in *The Journal of Agricultural Science*, Vol. VI, Part. 2, pp. 152-168. Cambrid May 1914.

The writers summarise their conclusions as follows :

" 1. The Sachsse method of estimating starch is unreliable in t case of plant material ; not only does the presence of pentosans falsify t results, as pentoses are formed during the hydrolysis, but actual destructi of dextrose occurs during prolonged treatment with dilute acid.

" 2. O' Sullivan's method gives low results owing to the loss of dextr which occurs during the purification of the solution after the conversi by diastase.

" 3. A method is described for estimating starch based on the use takadiastase ; under suitable conditions this converts the starch into malto and dextrose only, and no loss of these sugars occurs when the solution treated with clearing agents such as basic lead acetate.

" 4. The necessity of removing substances soluble in water, such gums, etc., which are optically active and thus cause error in the esti ation of starch in plant material is emphasised. Special care is al necessary in sampling ".

1101 – **The Estimation of Hydrocyanic Acid in Feeding-Stuffs and its Occurren in Millet and Guinea Corn.** — FURLONG, J. R., in *The Analyst*, Vol. XXXI No. 463, pp. 430-432. London, October 1914.

A new method of estimating hydrocyanic acid in feeding-stuffs described ; it consists essentially in the conversion of hydrocyanic ac into Prussian blue and in the comparison of the resulting coloration wi standards ; it avoids the disturbing influence of hydrolytic and distillati

Plant	Stage of growth	Hydrocyanic acid per c
Guinea corn	6 in. high	0.004
	12 » »	0.01
	18 » »	0.009
	24 » »	0.0025
	8 ft. full grown but unripe	—
	8 ft. full grown and ripe	—
Millet	6 in. high	0.006
	12 » »	0.018
	18 » »	0.022
	24 » »	0.045
	8 ft. 6 in. high	—
	11 ft. 6 » »	—

(1) See also No. 22, *B.* Jan. 1914.

oducts which accompany the hydrocyanic acid in the usual iodine or ver nitrate titration methods.

Millet and guinea corn (*Panicum maximum*) plants from Northern geria were recently examined for hydrocyanic acid by the above method. ie results are shown in the Table on the opposite page.

All the young plants contained a cyanogenetic glucoside, the amount ntained increasing up to a certain point in the life-history of the plant d then diminishing, so that the full-grown plants were free from such dies. The results indicate the probable course of the development d disappearance of the cyanogenetic glucosides in millet and guinea corn ants, but no general conclusions can be drawn until a larger number of mples have been investigated.

02 – **Some Accessory Factors in Plant Growth and Nutrition.** — Bottomley, W. B. (King's College, London) in *Proceedings of the Royal Society*, Vol. 88, No. B 602, pp. 237-247. London, September 15, 1914.

During the summer of 1913, a number of experiments were made at e Royal Gardens, Kew, (1) on a series of plants to test the manurial lue of Sphagnum peat which had been incubated with a mixed culture aërobic soil organisms for a fortnight at a temperature of 26° C. It d been discovered that by this bacterical treatment the humic acid in e peat is converted into soluble humates, and this bacterised peat, after erilisation, forms an excellent medium for the growth and distribution nitrogen fixing organisms. As the experiments progressed it was evint that, in addition to the ordinary plant food constituents, there was esent in the bacterised peat a substance which stimulated growth in a narkable manner. Further experiments showed that this substance s soluble in water, and was effective in very small quantities. It was und that seedlings of *Primula malacoides* potted up in loam, leaf-mould d sand, and treated twice with a water extract of only 0.18 gm. of cterised peat, were, after six weeks' growth, double the size of similar treated plants, and it was noted that flower production and root delopment were promoted equally with increase of foliage.

These results suggested that the growth stimulating action of the cterised peat might be due to the presence of a substance or substances nilar in nature to certain accessory food bodies known to play an imrtant part in animal nutrititon. The latter are also known to be soluble water and alcohol, so the bacterised peat was extracted with absolute ohol, the extract was evaporated to dryness, and taken up with warm tilled water, portions of 100 cc., containing the extract from 1 gm. peat, being placed in each of 12 flasks. Six of these were boiled for e minutes and all, including six other flasks, containing only distilled ter, received 0.2 gm. of potassium phosphate (K_2 H Po_4), 0.02 gm. magnesium sulphate and 0.2 gm. of calcium carbonate, and were inoated with 1 cc. of a uniform suspension of *Azotobacter chroococcum*. e contents of two flasks from each of the three series of six were analysed

(1) See also No. 410, *B.* May 1914.

at once to serve as controls while the remaining four of each series were incubated for eight days at 26° C., at the end of which period they were analysed by the Kjeldhal process for their nitrogen content. The results are given in Table I.

TABLE I.

Series		Nitrogen content	Nitrogen fixation
		mgm.	mgm.
I. Complete food	1 Control	0.4	—
	2 »	0.4	—
	3 Culture	4.6	4.2
	4 »	4.4	4.0
	5 »	3.6	3.2
	6 »	4.4	4.0
II. Complete food + alcoholic extract of bacterised peat	1 Control	2.6	—
	2 »	2.3	—
	3 Culture	20.7	18.2
	4 »	20.5	18.0
	5 »	19.9	17.4
	6 »	20.9	18.4
III. Complete food + boiled alcoholic extract of bacterised peat.	1 Control	2.3	—
	2 »	2.5	—
	3 Culture	19.6	17.2
	4 »	19.0	16.6
	5 »	20.6	18.2
	6 »	19.4	17.0

The results indicate clearly that there is present in the bacterised peat a substance which stimulates plant growth and which is of fairly stable nature, as almost equally good results were obtained with the boiled as with the unboiled extract.

In order to test whether the active substance is present as such in the original peat, or whether it is produced in the bacterised peat as a result of treatment, an extract of the raw peat was made in precisely the same manner as described for the bacterised peat and incubated as before. No increased growth was apparent in the cultures containing alcoholic extract of raw peat.

The active substance being evidently produced in the bacterised peat as a result of treatment, and since this treatment consists essentialy in the production of soluble humates by bacterical action, a test was made to ascertain whether the chemical production of soluble humates would be

equally effective. Two equal portions of raw peat were saturated with solutions containing 1 per cent. of their weight of sodium carbonate, and were stirred at frequent intervals for several hours. One portion was allowed to dry slowly at room temperature and an alcoholic extract taken as before; the other portion was leached with water until the washings were colourless, the water extract was then evaporated to dryness and the residue thus obtained extracted with alcohol. The effect of both the alcohol extracts was tested with *Azolobacter* and again the cultures failed to reveal any stimulation of the organism.

The accessory bodies concerned in animal nutrition have been shown to be precipitated by phosphotungstic acid; the alcohol extract of the bacterised peat was therefore treated with phosphotungstic acid and a fraction separated which was used in solution in the proportion of 17 parts per million. This fraction was tested upon wheat seedlings: ten seeds were germinated in clean sand in each of nine pots which were arranged in three series of three pots each. Series I was treated with a complete food solution (containing nitrogen, phosphorus and potash estimated as NH_3, P_2O_5 and K_2O in the proportion of 400, 200 and 1220 parts per million respectively). Series II was treated with complete food plus alcoholic extract from 10 gms. of peat per litre of solution, and Series III with complete food plus phosphotungstic fraction from 10 gms. of peat per litre of solution. Each pot was treated with 100 cc. of its solution one week after sowing the seed and the treatment repeated once a week for five weeks at the end of which period the plants were uprooted, washed, dried and weighed. The results are given in Table II. —

TABLE II.

Series	Weight of 30 plants (green)	Increase over Series I
	gms.	per cent.
I. Complete food	11.94	—
II. » » + alcoholic extract . . .	14.46	21.1
III. » » + phosphotungstic fraction	15.45	29.4

The results indicate that the stimulative substance in bacterised peat is precipitated by phosphotungstic acid and that this phosphotungstic fraction is quite as effective as the original alcoholic extract.

Again working by analogy with the accessory bodies concerned, in animal nutrition a further fractionation was carried out with silver nitrate. The final solution contained 0.35 part per million of the dry silver fraction and was also tested concurrently with the phosphotungstic fraction upon wheat seedlings as before. The results are given in Table III.

TABLE III.

Series	Green weight 45 plants	Increase over Series I	Dry weight at 100° C.	Increase over Series I
	gms.	per cent.	gms.	per cent.
I. Complete food	64.5	—	13.3	—
II. » » + phosphotungstic fraction	96.8	50.0	16.4	22.7
III. » » + silver »	91.5	49.6	15.7	17.7

The silver fraction having thus given results approaching the phos photungstic fraction its effect was next tested on wheat seedlings in wate culture. At first the growth of the test and control plants was approxi mately equal, but after the first fortnight the seedlings in the contro set seemed unable to utilize the food elements supplied to them whil those in the silver fraction series went on growing up to the end of th experiment (50 days).

It has previously been shown that seeds of barley, oats, peas an flax fed to guinea pigs, contained no accessory bodies having a curativ effect on scurvy, but that these were developed during germination. Thes facts indicating the possibility of the development during germinatio of special growth substances which enable the embryo to utilize the foo material present in the seed, a further series of water cultures was carrie out in which the wheat seedlings were carefully separated from their seed as soon as possible after germination. The difference in growth betwee the control and silver fraction set was even more marked than in the pre vious experiment as the control set never increased more than 5 per cent of its original weight, while at the end of the experiment the silver fractio set had increased 59 per cent. of its original weight.

It would therefore appear that during the germination of wheat seed certain substances are formed which enable the young embryo to utiliz the food materials present. The supply of these substances formed b the seed during germination is sufficient to establish the embryo as a independent seedling, then some other source is necessary. It has bee shown that these accessory food substances are produced when peat (de cayed vegetable matter) is acted upon by certain soil bacteria, and th natural inference is that during the bacterical decomposition of organi matter in the soil, that is during humus formation, these substance are formed, hence the beneficial effect of farmyard and other organi manures. The specific action of these accessory substances is not know and experiments are in progress to test various hypothesis in thi connection.

PLANT BREEDING

1103 — **Lax- and Dense-Eared Wheats.** — PARKER, W. H., in *The Journal of Agricultural Science*, Vol. VI, Part 3, pp. 371-386. Cambridge, September 1914.

The crosses which are here described were made in 1900 by Professo Biffen, with the object of continuing his investigations on inheritance o

susceptibility and immunity to attacks of *Puccinia glumarum*. The material, however, displayed so much diversity in the density of the ears that it was ultimately used only for investigating the mode of inheritance of this character.

With regard to preceding investigations, it should be noted that SPILLMAN, STRAMPELLI and v. RÜMKER all get an F_1 of intermediate character, and an F_2 of 1 dense : 2 intermediate : 1 lax ; while WILSON and TSCHERMAK find dense to be distinctly dominant in F_1, and the former got a ratio of 3 dense : 1 lax in F_2. NILSSON-EHLE and BIFFEN obtained different results from different crosses.

In the present investigation, two crosses were utilized : American Club × Square White and American Club × Square Ghurka.

American Club is a typical *compactum* wheat, while Square White and Square Ghurka are both *vulgare* wheats of hybrid origin which had bred true to type for a series of years.

In *compactum* wheats the average space between the spikelets of the ear in millimeters, or the density, is 2.1 or 2.2 while in *polonicum*, whieh is typical of the lax ear, it is 6.6. Between these two extremes there is an almost umbroken series among the *vulgare* wheats : the internode length of Square Ghurka vaiies from 3.9 to 5.1 and that of Square White is practicaly the same; they would thus both be considered lax by NILSSON-EHLE, whereas American Club is a typical *compactum* with internode length from 1.9 to 2.5,

The F_1 generation of American Club × Square Ghurka was apparently almost intermediate, but the tendency was toward the dense parent.

F_2 showed, besides all intermediate forms, a large number of plants the ears of which were either more lax or more dense than the ears of either parent. Their curve, though continuous, gives evidence that segregation is taking place. Offspring was grown from each plant of F_2 ; in F_3 nearly all of the lax-eared plants bred true to laxness and a certain proportion of the dense-eared plants bred true to denseness, but it was practically impossible to see which plants bred true to their particular degree of denseness or laxness. It is particularly noticeable that although a large porportion of the very dense-eared plants threw no lax, there were several which were heterozygous, and that the curves which the F_3 series form have shifted towards the high, or lax, side.

Similar results were obtained in the F_2 and F_3 of the Square White × American Club cross.

From the Square Ghurka American Club cross, 36 F_3 plants were grown on, being chiefly selected either because they lay between the two peaks of the curve or because they lay at the extremes of the curve. In the curve for the partial F_4 (1913), the peaks revert almost exactly to the position which they held in 1911, and this seems to suggest that some such factor as the wetness of the summer of 1912 was responsible for the shift shown in the curves for that year.

A fact which is noticeable in the descendants of the F_2 and F_3 plants is that in the non-splitting dense and lax, especially in the former, there seems to be a distinct correlation between the degree of density of the parent and the average degree of density of the offspring. There can only be two possible theories to explain this phenomenon. It may be due to nutrition, admitting that the grain of the very compact ears is lighter than that from ordinary ears, that weak plants develop from small grain and that the ears of weak plants are appreciably more dense than those of normal plants. But this theory is not very probable (see the works of JOHANSSEN and others). It seems safe therefore to conclude that the alternative theory is the true one, namely, that underlying the main 3 : 1 ratio, there are other factors which have a modifying effect on the laxness or denseness of the ear. This is probably also the explanation of the appearance of plants which exceed the limits of either parent.

From the comparison of the number of nodes and the rachis length of the ears of lax, dense and Squareheads Master wheat of 1912 (wet year) and of 1913 (relatively dry), it appears that the first number in 1913 was greater respectively by 33, 39 and 10 per cent, and the second was respectively greater by 15 and 21 per cent and smaller (Squareheads Master) by 2 per cent. Consequently, the larger variation is a meristic variation, and external conditions would seem to cause an alteration of nearly 40 per cent in the number of parts. As the nodes are already completely formed in young wheat plants, the conditions which control this variation can only be operative during the early life of the plant, while those which control the length of the rachis act during the whole growing-period of the plant. Thus weather experienced after the earlier period of growth might nullify the effect caused by the weather of that time, and then the variation of the two characters would become practically independent.

From the above it will be seen that the actual method of classifying wheats according to the density of their ears is unreliable, as the number of internodes and the total rachis length vary largely from season to season and it might be possible to get a variability of well over 50 per cent in a variety from one year to another, and that even when grown on the same soil with identical manurial and cultural conditions.

1104 – **On the Emasculation of Giant Maize in Serbia.** — HECKEL, EDOUARD, in *Comptes Rendus hebdomadaires des séances de l'Académie des Sciences*, Vol. 159, No. 16, pp. 595-597. Paris, October 1914.

Previous work (1) by the writer has shown that the giant maize of Serbia (13 feet in length of stems and 8 inches in length of ear), which normally contains about 9 per cent of saccharine matter in its sap at the beginning of September, has its sugar content increased to a maximum of 12 per cent by partial removal of the male flowers and to 11.57 per cent by removal of the female flowers. After the end of September the amount of sugar rapidly diminishes and at the period of harvest it is less than half.

Later experiments with plants grown close together under identical

(1) See No. 1618, *B.* Dec. 1912. (*Ed.*)

conditions have shown that the effect of emasculation on the sugar content of the sap is very variable and may even be negative. With the formation of a reserve of sugar there is also a formation of starch reserves, except when the sugar content remains low after removal of the male flowers or when the flowers are left intact.

The writer proposes to increase and to fix the sugar content by means of selection. Partial emasculation does not affect the yield of grain and is easy to carry out; it also provides a good winter forage much liked by stock.

1105 – **Alfalfa Hybridization.** — SOUTHWORTH, WILLIAM (Department of Plant Breeding, Ontario Agricultural College, Guelph, Canada) in *The Journal of Heredity*, Vol. V, No. 10, pp. 448-457 + 3 figs. Washington, October 1914.

Nothwithstanding the immense economic value of the present day strains of alfalfa grown in the United States they may still be improved on at least two lines:

1. To obtain a strain having the capacity to seed more freely under various environmental conditions.

2. To obtain a variety which will be better adapted for grazing

The first part of the problem might be solved by simple selection; unfortunately all the types which offer possibilities for grazing appear to be below the average in the production of seed. The writer therefore endeavoured to solve the problem by crossing with black medick (*Medicago lupulina* L.), which yields good grazing but not good hay. In the United States it is looked upon as a weed.

At the Ontario Agricultural College at Guelph experiments were commenced with the aim of breeding better strains of alfalfa. It was found necessary to arrange a preliminary series of experiments in order to elucidate the complex and still unsettled problem of the pollination of its flowers. The results obtained showed: 1) that alfalfa flowers are incapable of becoming fertilized when insects do not gain access to the flowers (1); 2) that if the stamens and pistil be liberated artificially the flower is capable of producing seeds; hence it is not self-sterile; 3) that bees are the most numerous visitants, but they have the power to extract the nectar from the flower without causing pollination; the bumble bee is fairly active in fertilizing the flowers; a species of *Andrena* is apparently very useful, too; but the most effective of all was found to be a wild bee belonging to the *Megachile* group, as it will pollinate from eight to twelve flowers a minute.

DARWIN and BURKHILL had observed, and the writer has confirmed their observation, that the flowers of *Medicago lupulina* are autogamous and produce seed even without the aid of insects. Burkhill found that where these flowers were left exposed to the visits of insects 95 per cent. produced seed; when enclosed in a net 75 per cent. set seed. In practice

(1) The results obtained by PIPER and his collaborators show that in sufficiently good conditions of temperature and dryness of the atmosphere, alfalfa produces seed spontaneously also (by automatic pollination) without the assistance of insects. See (*Ed.*).

M. lupulina produces abundant seed under any condition of climate and soil.

The writer commenced the work in 1911. The F_1 generation (24 plants) showed considerable variations, even among individuals produced from different seeds out of the same pod, and for the most part the plants differed considerably from both parents. Their height ranged from 7 to 23 inches; the stem in some was thin and flexible, in others rigid, and the leaves varied from few and small to many and densely crowded.

The second generation was obtained from a plant distinguished for its vigour and abundance of flowers and seeds. The plants composing it showed all the degrees between Talls and Dwarfs, ranging in height from 2 to 11 inches, 78 plants being above the height considered as medium, namely 5.5 inches, and 30 below it, which would give the ratio of Talls to Dwarfs as 2.6 to 1 instead of the calculated Mendelian ratio of 3: 1. As for the habit of growth, 88 plants were non-erect (3 prostrate and 85 decumbent) and 20 erect (12 semi-erect and 8 erect), which gives the ratio 4.4 non-erect to 1 erect, instead of 3 :1.

The experiments are being continued. In the course of these tests the writer observed that those seeds which remained hard and dormant after having been for several days in the germinator at 70° F., sprouted in one or two days, when replaced in the germinator after immersion for 10 minutes in strong commercial sulphuric acid and subsequent washing free from acid. The few seeds which resisted this treatment were treated to a second immersion in sulphuric acid, after which they sprouted.

AGRICULTURAL SEEDS

1106 – **Tree Growth and Seed.** — BERRY, JAMES B (Department of Forestry, Pennsylvania School of Agriculture, State College, Pa) in *The Journal of Heredity*, Vol. V, No. 10, pp. 431-434 + 2 figs. Washington, October 1914.

Dr. ARNOLD ENGLER (1), at the Forest Experiment Station of Zürich, has a number of investigations in course, which illustrate the inheritance by seedlings of the main characteristics of the parent tree. In one of these experiments two plots are occupied by spruce seedlings varying in height from 3 to 10 feet. The seedlings on Plot I show more than 50 per cent. crooked and twisted plants, while Plot II contains less than 5 per cent. of this material. The seed used on Plot I was collected from a gnarled and twisted mother tree, yet not an extreme form. The seed used in Plot II was taken from a mother tree of normal form grown under the same conditions as the deformed one.

A second experiment occupies two adjacent plots, both supporting a growth of spruce seedlings about 15 years of age planted at the same distances from each other. The seedlings on Plot I, while entirely healthy and vigorous, are rounded in form, very dense in character and with branches uniformly small; their height ranges from 12 to 30 inches and they are as broad as they are high. The seedlings on Plot II are entirely normal in form and growth; they are between 3 and 6 ft. in hight. The seeds of Plot I were taken from a mother tree which was characterized by density of

(1) Influence of Source of Seed. — *Journal of Heredity*, Vol. V, No. 4, p. 185, April 1914.

branching and slow growth, while, those of Plot II were from a normal mother tree grown on the same quality site and under similar conditions.

A third investigation deals with the effect of temperature in its relation to transmitted characteristics. Seed was collected from regions of mean temperature varying by 10° F, from that of Zürich to Northern Sweden, altitude and latitude both forming a basis for computation. Two or three rows were planted from each lot of seed, the arrangement being in regular order from the lowest to the highest mean temperature. At present, eight years after the inauguration of the experiment, there results a "terrace" like formation, the relative height growth varying directly with the mean temperature. Further, the plants resulting from seed from a locality of high mean temperature are the first to show active growth in the spring and, having a longer growing season, their annual increment is greater and their form is less dense. It is thus very important for the forester to know the origin of the seeds and the quality of the mother plants.

These facts may afford an explantion for some of the unsatisfactory results in forestry. For instance it is said that Scots Pine (*Pinus sylvestris*) gives very poor results in the United States and that it is not adapted to that country. The writer suggests that better results might be obtained by choosing the seed better.

The seedling resulting from seed from a region of higher mean temperature than that of the locality in which it is to grow will preserve its original slim bearing and the long willowy previous year's growth is easily crippled or broken by the weight of the snow. The seed should be chosen from localities having an average altitude and temperature similar to that of the place where it is to be sown, and lastly when regeneration of the forest is to be obtained by spontaneous seeding, the best plants should be left for this purpose and not the deformed and the cripples, as is too frequently done at present.

1107 — **The Controlling Influence of Carbon Dioxide in the Maturation, Dormancy and Germination of Seeds.** — KIDD, FRANKLIN (Fellow of St John's College, Cambridge) in *Proceedings of the Royal Society, Series B*, Vol. 87, N.s B. 597 and 599, Biological Sciences, pp. 408-422 and 609-625. London, June 1914.

The object of this research is to solve the problem of the non-germinating of maturing seeds while still upon the parent plant and the large number cases of delayed germination or non-germination of shed seeds which to all appearances are in good condition for germinating.

The dormancy of moist seeds must be due either to the absence of an essential stimulus or to the presence of an inhibitory agent. CROCKER found that *Xanthium* seeds would not germinate at a temperature of 19° C. though provided with a sufficient supply of water and a normal atmosphere with a partial pressure of oxygen equal to 150 mm. On removal of the testa, however, germination immediately took place. SHULL found that these seeds will germinate at a temperature of 21° C. with a minimal oxygen pressure of 12 mm. when the seed coat is removed, thus showing that the wet testa is able to reduce the partial pressure of oxygen in its passage through it, from 150 mm. pressure to less than 12 mm.

It is possible that the absence of germination during the maturation of the seed and later during its normal resting period may be due not only to an insufficient oxygen stimulus but also to some inhibitory cause, such as a relative rise in the actual carbon dioxide pressure in the embryo tissues.

Experiments were conducted with various seeds in atmospheres with various partial pressures of carbon dioxide. It was found that increases in carbon dioxide pressure retarded germination and that this retardation was not accompanied by injury. The seeds used in these experiments fell into two classes: 1) those which germinated at once after removal from the inhibitory doses of carbon dioxide (beans, cabbage, barley, peas, onions); 2) those in which the retardation continued indefinitely after removal from the carbon dioxide (*Brassica alba*) and was terminated only by complete drying and re-wetting, or by the removal of the testa.

This suggests that carbon dioxide lowers the degree of permeability of the testa in the second class of seeds, thus causing a reduction in the amount of oxygen reaching the embryo and a relative rise in the actual carbon dioxide pressure in the embryo tissues. The condition of prolonged inhibition after removal to air produced in *Brassica alba* is strikingly suggestive of the condition of seeds often met with in nature, the germination of which is delayed in spite of suitable conditions of temperature and water. Similar results were obtained with *Brassica alba* seeds in the soil under natural conditions by carbon dioxide arising from decaying vegetable matter. The high carbon dioxide content of the soil was found to continue for a considerable period (7 months). *It would therefore appear that caution is necessary in sowing seed in ground in which green crops or dung has been recently ploughed in.*

A further series of experiments was carried out to determine the relation of the retarding effect of carbon dioxide to temperature and oxygen supply. It was found that low temperatures and low oxygen supply both increased the inhibitory effect of given partial pressures of carbon dioxide and inversely a rise of temperature or rise of the partial pressure of oxygen diminished the inhibitory value of the given carbon dioxide pressure.

The growth of the embryo of a seed proceeds continuously after fertilisation and up to a certain point resembles in some respects the subsequent growth on germination. Beyond this stage partial inhibition begins and increases in the case of most seeds until, at the stage of complete maturation, growth is arrested or suspended. Experiments were conducted to ascertain the nature of this inhibiting factor. It was found that removal of the testa in the case of peas greatly increased the rate of germination, and that beans, germinated after complete air drying in the laboratory, at the moment of sprouting actually contain less water than when originally removed from the fresh green pods. It would appear therefore that neither lack of water nor any physiological insufficiency can be regarded as the factor limiting germination.

The carbon dioxide content of maturing and germinating seeds was then determined by grinding with baryta and titration with hydrochloric

acid. It was found that the carbon dioxide content of maturing seeds was considerably greater than that of germinating seeds in the case of peas and beans.

In the case of seeds with a low carbon dioxide content, the writer confirmed the conclusions of DRABBLE and LAKE that small quantities of carbon dioxide have a stimulating effect on germination. It would appear therefore that the effect of larger percentages of carbon dioxide is that of a true narcotic and that the *results induced by carbon dioxide in the resting seed are a phase of narcosis.*

In the case of rapidly deteriorating seeds, such as those of *Hevea brasiliensis*, the carbon dioxide naturally produced by respiration in a closed flask rose to 40 per cent, and the presence of this was found to be accompanied by a marked prolongation of the vitality of the seeds.

The biological importance of the dormancy of moist seeds in relation to the struggle for existence and in evolution is also pointed out.

CEREAL AND PULSE CROPS

1108 – **Studies upon Influences affecting the Protein Content of Wheat** (1). — SHAW, G. W., in *University of California Publications in Agricultural Sciences*, Vol. 1, No 5, pp. 63-126. Berkeley, Cal. October, 1913.

In 1905 the Merchants' Exchange of San Francisco, the State Board of Trade, the Sacramento Valley Development Association, and the more prominent millers and grain dealers of California, called the attention of the Agricultural Department of the University to the low gluten content of the local grown wheat, which necessitated the importation of many hundred tons of wheat per year to maintain the quality of Californian flour.

In 1906 the Department of Agriculture initiated these researches to investigate : 1) the effect of changes of environment upon the growth of cereals, particularly as regards the composition of the wheat kernel and with special reference to the causes of the production of a low protein content; 2) to discover or produce such wheat as will yield the largest profit per acre for the farmer, and will supply the millers with wheat of superior quality ; 3) to conduct similar experiments with oats, barley, and other cereals as may be desirable ; 4) to determine the effectiveness of various methods of culture as affecting the production of cereals.

This publication contains a very detailed account of the results of researches on the variation in the protein content of wheat grown under different conditions as regards : 1) latitude, 2) season, 3) time of planting, 4) time of harvesting, 5) amount of sunshine, 6) irrigation, 7) reduction of night temperatures and 8) the different fertilizers.

Summarising the results of this work carried out over a period of six years the writer draws the following conclusions :

1. There are important seasonal, varietal, and individual variations in wheat plants with respect to protein content.

2. The chief factor causing the most pronounced variation in protein content is climate, particularly the moisture supply in the final stages of

(1) See also No. 228, *B.* March 1913 and No. 331, *B.* April 1914. (*Ed.*).

growth. Wheat grown in the coast States is, as a class, much lower in gluten content than wheat grown in the central-west or the northwestern States.

3. The tendency of wheat kernels to change from a glutenous to a starchy condition is not constant, but is mainly dependent upon the individuality of the plant and seasonal influences, particularly moisture supply in later stages of growth. The use of a perfectly typical glutenous seed is invariably followed under Californian conditions by a lowering of the gluten content, as indicated both by the physical appearance of the grain and by its protein content.

4. In wheats all of which are entirely starchy there may be a reversion to an entirely glutenous condition in a single season, or the reverse may occur, according to the seasonal condition.

5. Allowing the grain to stand on the straw in the field until fully ripe does not materially affect the protein content.

6. The protein content of wheat is affected by the time of seeding, the product of late-seeded grain having a higher percentage of protein than that of early-seeded grain.

7. The protein content of wheat is very largely influenced by the water content of the soil in the later period of its growth, and the effect of either irrigation or rainfall during this period is to lower its protein content.

8. The percentage of sunshine which the grain receives during its period of growth has a somewhat direct bearing upon its protein content, but other seasonal conditions are more important.

9. Retarding the growth through cooling the atmosphere has a tendency to increase the protein content.

10. The quantity of available nitrogen beyond that required to supply normal growth has little, if any, influence upon the protein content.

11. The low gluten content of Californian wheats is not due to soil exhaustion, but rather to the following causes: *a*) the long growing period, *b*) relatively early seeding, *c*) the use of varieties of naturally low gluten content, and *d*) the absence of selection of highly glutenous seed.

1109. — **The Variaton of Gluten in Wheat Flour and Grain.** — MARCHADIER and GOUJON (Director and Chemist of the «Laboratoire municipal agréé du Mans»), in *Journal de Pharmacie et de Chimie*, Year 106, Series 7, Vol. X, pp. 191-202. Paris, September 1914.

According to BALLAND (1), the decrease in gluten in flour observed of late years, that is to say since roller-mills have been substituted for grindstones, is due not only to a degeneration of the grain, but also to methods of grinding which eliminate the germ and the portions of the grain which are richest in nitrogen, to more complete sifting and to the hydration caused by excessive moistening with a view to facilitating the removal of the pericarp.

(1) See No. 778, *B.* Aug. 1914. (*Ed.*).

According to VUAFLART, the decrease is to be attributed to atmospheric variation. SCHRIBAUX observes that in 1911 (a hot year) the grain was much richer in gluten than in 1912 (a rainy year) and that glutenous varieties grown near Paris had a lower gluten content. On the other hand the gluten content increases in the case of wheat grown on almost virgin soil, without any fertilizer, in the plains of America.

Gluten is a characteristic of wheat flour. It is stated that gliadin and glutenin (which is an oxidised anhydride of the first) are wholly, or partially, transformable into one another. FLEURENT has shown that a flour produces a softer dough and more digestible bread, the nearer the composition of the gluten approaches to 75 per cent gliadin and 25 per cent glutenin. A deviation of only 2 per cent from this proportion is sufficient to cause a noticeable difference in the bread.

It has been observed that the addition to wheat flour of only a small quantity of other flours causes a great change in the gluten, and a decrease in the amount which is capable of coagulating. When the amount of the other flour introduced passes beyond certain limits, the gluten no longer coagulates at all. Thus its power of coagulation disappears on the addition of 40 per cent of rye flour (COLLIN), 40 per cent of barley meal, 65 per cent of rice flour, 70 per cent of maize flour. These facts have been proved by experiments made by the writers.

The coagulation of gluten is also prevented or hindered by the addition of powdered minerals, and by wheat starch, which suggests that the result is due simply to physical causes.

If the amount of gliadin be diminished, the quantity of gluten decreases in a parallel manner, and since the smallest variation in the proportion of gliadin to glutenin is sufficient to cause very sensible changes in the bread-making quality of the gluten, in the same way a variation in the total of gliadin + glutenin in the paste brings about very rapidly: first the occlusion of a part of this gluten, and finally the complete loss of its power of coagulation.

As has been said, this abnormal decrease in the coagulable gluten has also been noted in the wheat grain. Further, it has been recorded, that gliadin and glutenin are easily transformed into one another, the slightest influence being sufficient to bring about the change. In germination, the ferments which produce solubility hydrate the glutenin, transforming it into gliadin: the proportion $\frac{\text{glutenin}}{\text{gliadin}} = \frac{1}{3}$ is altered, whence the flour gives a lax dough and the bread made from it rapidly hardens and is indigestible.

By too rapid grinding, the grain becomes heated, this giving rise to the dehydration and oxidation of the gliadin to form glutenin.

Keeping damp flour in a warm place in the presence of dry air causes slight oxidation and dehydration of the gliadin and improvement of the product. If, on the other hand, a good flour is kept in a damp warm atmosphere, the glutenin becomes hydrated and is transformed into gliadin and the product deteriorates. Such hydration may also be the effect of

meteoric influence: in fact the wheat of wet seasons always yields inferior flour.

It is well known that when the acidity of flour is above 0.050 per cent, the coagulation of the gluten is hindered and its elasticity either lessened or lost. An increase of 0.025 per cent in acidity corresponds to a decrease of 10 per cent in the damp gluten *i. e.*, of a little more than 3 per cent in the dry gluten.

It is logical to admit a similar effect of acidity upon the grain also, and it cannot be denied that acids influence the formation of gluten.

Nowadays, and especially during the last twenty years, the soils under wheat in Europe have been dressed with superphosphates, which carry into the soil their acid reaction.

This super-acidity due to strong acids (sulphuric chiefly and hydrofluoric in some cases) must have some effect upon the elaboration of gluten in the grain. In fact species of wheat rich in gluten become softer when cultivated in Beauce and Brie, districts which are highly cultivated and much manured with superphosphates, while the gluten is preserved in wheat grown on the unmanured soils of America.

There are no data at hand to show that the acidity of grain has diminished during the last twenty years, but according to the writers three facts speak in favour of their hypothesis :

1) On adding rye flour to wheat flour, while the gluten diminishes the acidity increases.

2) Rye flour, which contains no gluten, possesses an acidity ten times greater than that of wheat flour.

3) Acetic acid oxidises and dehydrates gliadin, and when a wheat flour with the proportion $\frac{\text{glutenin}}{\text{gliadin}} = \frac{1}{3}$ is treated with this acid, a gluten is obtained by evaporation, in which this proportion is equal to one.

In conclusion, the diminution of gluten in native wheats is principally due to the effect of acidity.

1110 – **Experiments with Autumn Sown Crops in Ontario, in 1911.** — ZAVITZ, C. A., in *The Agricultural Gazette of Canada*, Vol. I, No. 9, pp. 740-742. Ottawa, Canada, September 1914.

Winter wheats. — About 280 varieties of winter wheat and a large number of selections and crosses have been grown under experiment at the Ontario Agricultural College at Guelph, during the past twenty-five years. Nearly all the varieties have been carefully tested in each of five years, after which the inferior kinds have been discarded and those which have given the best results have been continued in the experiments. Of the named varieties, the fourteen given in Table I were grown for nineteen years. The average yields during this period are shown in the Table. The lowest average yields in the nineteen years were 20.2 bushels in 1912; 28.3 bu. in 1895; 32 bu. in 1908; 34.1 bu. in 1904; and the highest yields have been as follows: 66.7 bushels in 1900; 61.6 bu. in 1902; and 60.5 bu. in 1903. In 1899 and 1901 the results were so poor that no satisfactory returns could be made.

TABLE I. — *Yield per acre of winter wheat, average of 19 years.*

Variety	Tons straw	Bushels grain
Dawson's Golden Chaff	2.9	51.1
Imperial Amber	3.2	48.1
Early Genesee Giant	3.0	46.5
Egyptian Amber	3.2	46.4
Early Red Clawson	2.8	46.1
Rudy	2.7	45.0
Tasmania Red	2.9	44.4
Geneva	3.0	43.9
Tuscan Island	2.9	43.3
Kentucky Giant	2.8	43.2
Turkey Red	2.7	43.0
Treadwell	2.8	41.7
Bulgarian	2.8	41.5
McPherson	2.6	41.5

The varieties of wheat which produced the largest loaves from equal quantities of flour, as it appears from careful tests for bread production carried out at the Bakery Branch of the Chemical Department at the Guelph Agricultural College, were as follows: Banatka, Crimean Red, Yaroslaf, Tuscan Island, Tasmania Red, Egyptian Amber, Buda Pesth, Rudy, Treadwell, McPherson and Bulgarian.

In 1913 the Agricultural College distributed five varieties of winter wheat to a great number of farmers who wished to test them in various parts of Ontario. The average yields per acre are given in Table II. It will be seen that Imperial Amber, which occupies the second place in the average of the College experiments, is classed first in the cooperative experiments with farmers. Crimean Red, although a rather weak-strawed variety, is a good yielder and produces grain of excellent quality.

TABLE II. — *Average yield per acre of winter wheat in 1913-14, in various parts of Ontario.*

Variety	Tons straw	Bushels grain
Imperial Amber	1.63	31.7
American Banner	1.40	30.8
Crimean Red	1.34	30.4
Banatka	1.28	28.8
Yaroslav	1.57	28.3

In the cooperative experiments with the farmers, different fertilizers were applied in the autumn to winter wheat: the average yields of grain per acre for eight years were as follows:

	bu.
Farmyard manure: 20 tons per acre	25.8
Mixed fertilizer: nitrate of soda 53 lb., chloride of potash 53 lb. and superphosphate 107 lb. per acre.	23.5
Nitrate of soda: 160 lb. per acre	22.5
Chloride of potash: 160 lb. per acre	21.5
Superphosphate: 320 lb. per acre	21.2
Without manure	18.1

Winter rye. — In each of the past eleven years four varieties of winter rye have been under experiment at the College. The following average results in yield of grain and in weight per bushel have been obtained.

	Bu. per acre	Bushel weight lbs.
Mammoth White	58.3	57.5
Washington	55.2	57.6
Common	53.2	57.0
Thousand Fold	53.0	57.4

1111 – **On the Botanical Origin of Cultivated Rices.** — CHEVALIER, AUG., and ROEHRICH, OLIVIER, in *Comptes Rendus hebdomadaires des Séances de l'Académie des Sciences* Vol. 159, No. 14, pp. 560-562. Paris, October 5, 1914.

The extensive geographical distribution of cultivated rice and the antiquity of its cultivation have prevented botanists from determining whether the numerous varieties are derived from one common type or from several, as well as from discovering precisely in which country they originated.

The wild rices of Asia, except one found in Indochina by one of the writers, are distinct from the cultivated varieties. This exception shows no specific differences from cultivated rices and is probably the original species from which all the varieties of the species *Oryza sativa* have been derived.

Four wild species distinct from *O. sativa* have been found in Africa. Nevertheless one of them appears to belong, if not to the original type, at least to a type very similar to some varieties cultivated exclusively in West Africa, and which is often found amongst the crops of the typical rice introduced from the Middle East by the Portuguese some centuries ago.

The five principal species studied by the writers are as follows:

1) *O. latifolia* Desv. = *O. punctata* Kotschy. The species *O. punctata* of the Egyptian Soudan is identical with *O. latifolia* of India and M. Chevalier found that it occurs also in Dahomey.

2) *O. breviligulata* A. Chev. et Roehrich. = *O. Barthii* A. Chev. *pro parte*: occurs wild in the regions of the Soudan (French Nigeria) inundated

(1) See also, No. 802 *B.* March 1911. (*Ed.*).

by the Niger and in the swamps of Baguirmi. A certain number of wild rices of Central and Western Africa are related to this species, and only differ from it in a few characters. Some of the cultivated rices of West Africa are also related to this species. *O. glaberrima* Stend. is a variety of these cultivated rices, of which some show also a second variation of long glumes.

3) *O. brachyantha* A. Chev. et Roehrich. = *O. Barthii* A. Chev. *pro parte*: in the Western Soudan and Egyptian Soudan.

4) *O. longistaminata* A. Chev. et Roehrich. = *O. Barthii* A. Chev. *pro parte*. Perennial rice with rhizomes, largely distributed throughout tropical Africa (Senegal). It is the perennial rice of Richard-Toll found by AMMANN (1). It is found growing with other wild rices in Nigeria, Baguirmi, Chari, Egyptian Soudan, Tanganyika, and the Belgian Congo.

5) *O. sativa* L. (*sensu lato*). Occurs wild in Annam, Cochinchina and Cambodia, on lands flooded during the rainy season and in rice fields which remain wet after the harvesting of cultivated rices. It is considered as a weed by the natives.

1112 – **Accumulated Fertility in Grass Land in Consequence of Phosphatic Manuring,** — SOMERVILLE, W. in *The Journal of the Board of Agriculture*, Vol. XXI, No. 6. pp. 481-492 + 1 pl. London September 1914.

FORAGE CROPS. MEADOWS AND PASTURES

During the past 20 to 30 years extensive areas of grass land have been treated with phosphatic manures, notably basic slag, and in most cases, with large profit.

The initial cost of the manure, about £ 1 per acre, is, in the great majority of cases, recovered with interest in the first 3 or 4 years by the greater production of grass, so that the accumulated nitrogen and humus is practically gratuitous.

The experiments carried out by the writer at Oxford were calculated to determine to what extent the soil is enriched by the phosphatic manures applied to grass land. Samples of soil were taken from five farms which included grass fields, part of each of which had been treated with basic slag in previous years, while part had been left untreated. Two sets of flower pots were filled with the soil from each centre, five with the treated and five with the untreated soil. The experiments with the soil of one farm had to be abandoned, so the results apply to four localities only. Each pot contained the same weight of dry soil, about 3 lbs., and was sown with Black Bell oats which were thinned down to seven plants in each pot. The five pots filled with soil from the manured part and the five from the unmanured portion of the grass land from each locality were treated as follows: Nos. 1 and 2 did not receive any direct manuring for the oats; No. 3 was given 1 gram of basic slag, equivalent to a dressing of 15 cwt. per acre; No. 4, 0,5 gram of rape meal, equal to about 7.5 cwt. per acre; and No. 5, 0.5 gram of rape meal and 1 gram of basic slag. When the plants were mature they were harvested and yielded the following results:

(*Ed.*)

(1) See also, No. 802 *B.* March 1911.

	Total weight of plants — grams	Total weight of seeds — grams
Unmanured oats:		
8 pots of untreated soil	82	22.980
8 » » treated »	136	34.140
Oats manured with slag:		
4 pots of untreated soil	56	14.600
4 » » treated »	81	17.260
Oats manured with rape meal:		
4 pots of untreated soil	41	11.055
4 » » treated »	60	17.605
Oats manured with rape meal and slag:		
4 pots of untreated soil	46	14.110
4 » » treated »	67	19.735

Thus even the abundant manuring with rape meal and slag yielded a crop inferior to that due to the accumulated fertility in the grass land that had received phosphatic manure.

The experiment is being continued; the same pots were sown with white mustard; at the end of August its appearance showed evidently that a single crop had not exhausted the accumulated fertility in the soil.

The writer summarises the results as follows:

1. Phosphate manures, besides having a direct beneficial effect on grass land, are advantageous to the tillage crop grown on the broken-up pasture, which is likely to be improved by 50 per cent.

2. Naturally, such improvement will vary with circumstances. In the above experiments the productive power of a soil that had been dressed three times with 10 cwt. of basic slag per acre during 17 years was increased 153 per cent; while another soil that had received 7 cwt. of basic slag only three years previously was improved by 124 per cent. The other two soils showed improvement of 31 and 15 per cent.

FIBRE CROPS

1113 – **Cotton in South Africa.** — Taylor, H. W. (Assistant Chief of the Tobacco and Cotton Division and Officer in Charge, Rustenburg Experiment Station) in *The Agricultural Journal of the Union of South Africa*, Vol. VIII, No. 2, pp. 160-175 + 8 figs. Pretoria, August 1914.

In those districts where the soil and climatic conditions are favourable to the growth of cotton, farmers in South Africa will find that it will prove a remunerative crop for their non-irrigable lands. This has been demonstrated by experiments conducted by the Rustenburg Experiment Station of the Tobacco and Cotton Division of the Department of Agriculture, where eight varieties of cotton gave yields of more than 1100 lbs. of seed cotton per acre. Of these, three gave more than 1400 lbs. and one variety went as high as 1684 lbs. of seed cotton per acre. Each of these varieties gave yields of more than 400 lbs. of lint and two gave more than 520 lbs. per acre.

In the Cape Province most gratifying results have been obtained. Of six varieties tested in Pondoland in 1911, five gave yields of more than 1000 lbs. of seed cotton per acre, and one variety as much as 2067 ½ lbs. of seed cotton per acre.

Experiments are just being established in Natal, but from previous results it may be said that cotton is a crop eminently suited to a large part of that Province. On the British market practically every consignment of South African cotton has realized higher prices than American cotton of similar types.

The soils which give the best results are sandy and clay loams and alluvial soils. Considering the irregularity of the climate in South Africa, the crop is not so certain on light sandy soils, on stiff clays and on turf soils, in the latter of which cotton germinates badly during dry seasons. Since cotton is planted in October or November, it is necessary that the rainfall during these months and December be sufficient, or else a full yield will not be obtained; these three months may therefore be considered the critical period of cotton cultivation in South Africa.

Among the staple crops grown in South Africa, cotton is the least exhaustive of soil fertility, as may be seen from the accompanying table, which gives the amounts of plant food removed from the soil by various crops.

Crop	Nitrogen — lbs. per acre	Phosphates — lbs. per acre	Potash — lbs. per acre
Cotton	21.36	10.97	9.21
Maize	73.74	23.96	63.06
Wheat	33.32	10.20	16.82
Tobacco	56.00	7.00	69.00

At the present time this Division is not in possession of sufficient data from all sections of the Union to be able to advise what varieties to grow in each of the several districts. From the results already obtained, it can be stated that for the greater part of the Transvaal the varieties of the big-boll group, including Cleveland, Christopher, Russell's, Pullnot, Bancroft and Bohemian, give the best results. In some parts of the Transvaal, where the soil is very fertile and the growing season long, the best results are obtained from Cook's Long Staple. This applies to the vicinity of Tzaneen and the Brak River Valley. Along the coastal belt the best returns have been secured from the varieties of the long staple group, which includes Cook's Long Staple, Nyassaland, Griffins, Sunflower and Allen's.

All the above varieties are annuals. The results obtained with the perennials have not, as yet, been sufficiently satisfactory to recommend their cultivation.

1114 – ***Urena lobata* in its Wild State in Madagascar.** — DROUHARD, E., in *Colonie de Madagascar et Dépendances, Bulletin économique*, Year 14, Part 2, No. 2, pp. 142-145. Antananarivo, 1914.

This plant occurs in a wild state in Madagascar, but it is not used by the natives as a textile plant. They occasionally use it in the manu-

facture of their of ropes, but they do not cultivate it; on the contrary they destroy it by setting it on fire when it is dry, but the seeds retain their vitality owing to their thick shell.

It grows in a wild state in the State of São Paulo, Brazil, and is cultivated with success in the neighbourhood of Campinas, whilst the fibres are worked in a spinning mill and weaving shed at São Paulo.

The plant is cut at the end of the flowering season and retting is carried out by the ordinary process of immersion of the fresh or dried stems in water. The water should be clear and running with a strong current. Retting lasts from 5 to 15 days or more according to the age and thickness of the stems, the best fibre being obtained from the thinnest stems.

The process of decorticating is very simple and it is easier when the stalks are dry. The fibre is used like jute in the manufacture of sacks and cloth. A native of Madagascar can cut about 440 lbs. of green stems per day, and 100 lbs. of stems yield about 5 lbs. of dry fibre.

The crop may be sown broadcast or better by means of a drill, but it should always be sown thickly, to prevent branching and to obtain very long stems. There is little disadvantage in cutting after the maturation of the seed, the fibre being perhaps of slightly less fine quality.

Though the plant occurs in rich alluvial soils, it adapts itself also to poor soils.

1115 – ***Agave Sisalana* and *Fourcroya gigantea* at Cape Verde.** — *Revista Colonial*, Year II, No. 21, pp. 289-290. Lisbon, September 25, 1914.

Agave Sisalana was introduced into Cape Verde some years ago in the form of bulbils, which were distributed amongst the agriculturists in different localities. They appear to have struck wherever planted, but though they developed into good plants in the high lands and valleys, they were stunted in growth in the arid soils near the coast.

Fourcroya gigantea has been established in the wild state in the mountainous islands in the Cape Verde Archipelago for more than a century and in some places it covers considerable areas. The fibre is prepared by the natives, but in such a crude manner as to render it unfit for export. In 1908 private enterprise attempted mechanical extraction with considerable success, the fibre being now sold in the markets of Hamburg, London, Antwerp and Marseilles. In 1903 the Portuguese Government carried out experiments at the National Rope Factory (Cordoaria Nacional) with textile fibres from the colonies. *Fourcroya* fibre from Cape Verde was tested and gave good results.

On the initiative of the present Governor, important plantations of Sisal and *Fourcroya* have been established on certain State lands (Ruy Vaz, Cancello, Trinidade, at an altitude of 1000 to 2500 feet). At the beginning of April, 1914, 620 000 plants had been planted and 80 000 more will be planted before the end of the year. Since the bulbils require a considerable time to grow, plants which will begin to yield in 3 years and yield about 1 ton of fibre per 1000 plants per annum after 5 years, have been bought from the natives. The present price of the fibre is £ 30 per ton.

1116 – **The Seeds of *Trichilia* from the Nigerian Sudan.** — AMMANN, P. and VUILLET, J. in *L'Agronomie Coloniale*, Year 2, No. 14, pp. 34-36. Paris, 1914.

The various species of *Trichilia* have not yet been thoroughly investigated, although they yield various interesting products; the bark of some of them is an excellent substitute for Ipecacuana, while their seeds contain varying quantities of fatty matter suitable for soap and candles.

M. F. PELLEGRIN, in a monograph on the Meliaceae of West Africa, enumerates 12 species of *Trichilia*, of which 6 belong to West Africa proper and 6 to Equatorial Africa. The six species belonging to West Africa are: *T. Prieureana* A. Juss, *T. emetica* Vahl and *T. Hendelotti* Planchon, all of them small trees belonging to the savanna region; *T. acutifoliata*, *T. Candollei* and *T. cedrata*, all three described by A. Chevalier and forming large trees in the virgin forests of the Ivory Coast.

The seeds of *T. emetica* have been exported from Mozambique to Marseilles for a long time under the name of *Mafuraires*. It was therefore desirable to know if the West African products gave seeds of equal value. Seeds were therefore obtained from various species found between Bamako and Koulikoro and studied at the Chemical Laboratory of the Colonial Garden of Vincennes. The types of seeds were as follows:

I. Small dark red seeds.
II. Medium-sized seeds of orange vermilion colour.
III. Large orange-coloured seeds.

The results of the analyses are given in the Tables I and II.

TABLE I. — *Analysis of seeds.*

	I	II	III
Weight of 100 seeds, gms	12.7	29.4	79.1
» » 100 kernels, gms	4.68	17.08	46 04
Percentage of kernels in seeds	36.9	58.1	58.2
Shells %	63.1	41.9	41.8
Moisture % in shells	6.42	4.16	4.74
» » in kernels	5.73	6.71	5.76
Fat in shells	41.50	38.10	51.90
» » kernels	30.10	44.70	43.70

TABLE II. — *Analyses of the fats.*

	Medium seeds.	Large seeds.	
	Fat of kernels	Fat of kernels	Fat of shells
Colour	light brown	light brown	lighter brown.
Solidifica ion point of glycerides	18°–19°	15°–16°	abont 13°
Acidity % as sulphuric	0.97	0.49	0.53
» % as oleic acid	5.60	2.82	3.05
Fixed insoluble fatty acids %	92.0	90.3	92.0
Melting point of insoluble fatty acids	52°	51.5°	44°
Solidification point » »	48.4°	47.2°	40.5°
Glycerine %	6.3	—	5.8

The large seeds most nearly approach the Mafuraires from Mozambique as regards size and fat content. The medium seeds are identical with those of *T. Prieureana* preserved in the Kew Museum.

French West Africa should be able to export at least several hundred tons of the Mafuraire seeds each year.

RUBBER, GUM AND RESIN PLANTS

1117 – **Recent Data on Rubber Plantations.** — Plantation Rubber Acreages. — Rubber Planting in Malaya. — WILLIAMS, G. C. (Rangoon): Rubber Cultivation in Burma — Report of Gold Coast Government.— *The India Rubber World*, Vol. 4, No. 6, pp. 678-679. New York, September 1, 1914. — Rubber Cultivation in India *Daily Consular and. — Trade Reports, Issued by the Bureau of Foreign and Domestic Commerce*, Year 17, No. 197, p. 1034. Washington, August 22, 1914.

The area under rubber in 1913 is estimated at 1 250 000 acres, distrfbuted as follows :

Malaya, etc.	500 000 acre
Java.	150 000 „
Sumatra, etc.	250 000 „
Ceylon	220 000 „
India and Burma	50 000 „
German Colonies	60 000 „
Borneo	20 000 „

In 1910 the total acreage under rubber was 767 000 acres, in 1911, 865 000 and in 1912, 987 000. It will thus be seen that the increase shown by 1913 over 1912 is about 27 per cent.

The following table shows the relative importance of the rubber acreage in various parts of the Malayan peninsula :

	1912 Acreage	1913 Acreage	1913 Output in tons
Federated Malay States	399 197	433 324	21 229
Straits Settlements	94 263	111 316	6 047
Johore	91 827	117 022	1 646
Kelantan and Kedah	34 837	45 373	246
Trengannu	1 497	1 510	Not yet producing
	621 621	708 545	29 168

In 1912 there were in all 235 912 workers employed on the Malayan estates.

The production of rubber in India is confined to Assam, Burma and the Madras Presidency, which exported in the fiscal years ending March 31, 1913 and 1914, 14 627 and 23 264 cwt. respectively. The acreage under rubber and the number of trees in 1913 was as follows :

	Acres	No. of trees
Assam	4 681	137 430
Madras	12 022	1 636 476
Burma	29 544	4 911 399

The yield of the Assam plantations is relatively small and the number of trees to the acre much less than in Madras and Burma. In 1913 the outturn of Madras was still more than double that of Burma, because most of the trees in Burma, being less than six years old, are not yet productive.

In 1914 the total acreage under rubber cultivation was about 34 000 acres. The rubber-growing districts are in Lower Burma, including Tenasserim. The soil is principally a reddish yellow friable sandy loam, with occasional districts which have a subsoil of laterite. The land is easily drainable. It is slightly undulating and in nearly all cases is protected from the south-west monsoon by high ranges of hills.

The rainfall varies slightly in different districts, from 110 inches in North Tenasserim to 200 in Tavoy. There are two seasons: December to April, the dry or cold season, and May to November, the wet or monsoon season. The driest months are February and March, when there is very little or no rain, but there are heavy mists and dews which compenste for the lack of rain. The temperature is about 88.8° F. in the daytime and 74° F. at night—the mean temperature for the year being about 80° F.

All planting is stump planting about 9 to 12 months old. The plants attain a height of from 10 to 12 feet and a girth average of 2 1/2 to 4 inches in one year. All the trees can be tapped in 4 years from the date of planting, the girth average 3 feet from the ground being 18 to 24 inches and more if planted 20 × 20 feet. The average yield for 4 to 6 year-old trees 1 1/2 to 3 lbs. per tree per year. The rubber is of excellent quality. Tapping can be done now practically all the year round. It is principally done by Burmese girls.

The capital invested is from £ 22 to £ 25 per acre to bring to bearing. The average cost of production is about 1*s* 6*d* to 1*s* 10 1/2 *d* per pound.

The exports of rubber from the Gold Coast Colony in 1912 were 1 990 699 lbs. as against 2 668 667 lbs. in 1904. The average annual yield of Para rubber (Hevea) at the several experimental stations was 3 3/4 lbs. per tree. *Funtumia* has given over 56 per cent of its total yield at the first tapping, in contrast with Para, where the quantity of latex tends to increase after the first tapping.

1118 – **Rubber: Tapping and Tapping Systems.** — SPRING, F. G. (paper read at Batavia Rubber Congress) in *The India Rubber Journal*, Vol. XLVIII, No. 14, pp. 15-16. London, October 3, 1914.

Under normal conditions from 300 to 350 trees per tapping coolie per day are recommended if work of good quality is to be maintained. At least twenty cuts to the inch of bark removed should be obtained, and when four years is allowed for bark renewal the cuts should be 18 inches apart. The depth and uniformity of cut are extremely important. It is considered a bad practice to place water on the cuts to facilitate the flow of latex.

In discussing the merits of the different tapping systems two points require consideration: 1) the production of maximum yield of rubber at minimum cost, and 2). the maximum yield of rubber with minimum injury to the tree. With regard to the periodicity of tapping it is generally

recognised in Malaya that daily tapping, over a period, gives more total rubber than alternate-day tapping, but that the latter yields more per tapping. In the case of young rubber, the difference is at its minimum, but as the tree ages the excess of rubber obtained in daily tapping increases and becomes sufficient to pay for the additional labour involved. This age limit appears to be about six years for trees planted at sufficient distance apart to allow good bark renewal. Bark renewal depends on the age of the trees and their distance apart.

At least four years should be allowed for bark renewal in the case of young trees and six years for old trees, especially if the distance of planting is small.

The writer has conducted experiments to test the merits of the following tapping systems :

1. *Opposite qaarter system.* — This system is unsatisfactory on account of the high cost of marking out the guiding lines, tapping, collecting latex and washing cups, and requires double the number of latex cups, spouts and holders. It is also doubtful if the renewal of bark in this system is as rapid as in others.

2. *Single quarter (or half herringbone) system.* — This system is largely in use in the Malay Peninsula. At the Kuala Lumpur Experimental Station it was found that two cuts gave considerably more total rubber than three in the case of young trees, and since the length of the cuts increases with the age of the tree, it is doubtful if it is advisable to have more than two cuts even with old trees. It has been found in Java (1) that more rubber is obtained by tapping to the left than to the right of the vertical channel. This system is infinitely superior to the opposite quarters system and over a period of two years it has given results nearly equal to the 'V' system. The superiority of the latter system cannot be decided until the results of tapping the renewed bark are known.

3. *The 'V' system.* — Some planters object to this system since it tends to flatten out the trunk of the tree. This is however no disadvantage and the results of the Kuala Lumpur experiments show a gradual and continuous increase in yield greater than that of any other system

SUGAR CROPS

1119 – **The Use of Sweet Sorghum as a Source of Commercial Sugar or as Fodder.** – ANNETT, H. E., (Agricultural Chemist to the Government of Bengal) in *Agricultural Research Institute, Pusa, Bulletin* No. 41, 9 pp. + 2 diagrams. Calcutta, 1914.

From time to time attempts have been made to grow sweet varieties of sweet jowar (*Sorghum* sp.) for the purpose of sugar production. The seed has in many cases been imported from America, but in certain parts of India local varieties are found which contain much sugar.

The experiments here described were made at Lyallpur and at Gurdaspur, Punjab.

At Lyallpur a local variety was grown. It was sown on July 2 at the rate of 12 lbs. per acre, without manure ; the ground was irigated four times. In order to determine the best time for the harvest, the whole

(1) See No. 1039, *B.* Sept. 1913. (*Ed.*

plot was divided into 20 equal sections which were gathered two at a time at 10 different intervals. From every lot the juice was boiled down. The best results were obtained from the sections cut towards the end of October or beginning of November. The lot cut on November 9 yielded 6 tons to the acre of stripped cane with 6587 ½ lbs. of juice, and from this 875 lbs. of raw sugar (gur), or 13.3 per cent, containing 57.90 per cent sucrose and 13.42 per cent reducing sugar, were obtained. This is quite a poor quality gur.

From the results of the Lyallpur and Gurdaspur experiments it appears that as a source of sugar, saccharine jowar is not worth growing in India. Even in America it is only grown to make syrup, for which there is a demand in that country, while there is none in India.

The high glucose ratio of the juice militates against the production of good crystalline gur. The juice contains also substances which produce, at times, a very objectionable taste in the gur.

The yield per acre obtained from a very good crop of sorghum only worked out at about 8 cwt. per acre. Hence the yield of sugar per acre would be only about one-third of that from the average country sugarcane crop.

These results tally with others obtained previously at Poona with the Collier and Amber varieties, which yielded 1174 and 1072 lbs. of molasses per acre respectively.

The experiments made by the writer indicate that the total sugar content of the crop is highest when the seed contents begin to dry. Thereafter until the seeds are dead ripe the total sugar in the crop decreases, but the decrease is mainly at the expense of the reducing sugar. As the plant approaches ripeness the amount of juice expressed from it decreases.

As a source of fodder saccharine sorghum seems valuable. The crop is fairly quick-growing and, as has been seen, yields abundant green produce. After the seed is in the thin milk stage no increase in total weight of the crop takes place and also the amount of total sugar in the crop has almost reached its maximum. Hence, when being cut for fodder, the crop should not be allowed to get beyond this stage.

1129 – **Tea: Manuring Experiments at Peradeniya.** — BAMBER, M. K., in *Department of Agriculture, Bulletin* No. 9, pp. 119-134, 3 plates. Colombo, Ceylon, May 1914.

STIMULANT, AROMATIC, NARCOTIC, AND MEDICIN CROPS

This circular contains a detailed account of the results of manurial experiments on the tea plots at Perideniya since 1911. Though no obvious conclusions are drawn from the tabulated results, the writer states that the experiments continue to bear out the advantages of green manuring, and demonstrate that with this class of tea, the application of expensive nitrogenous manure is not essential for the production of highly profitable yields.

As a green manure., Dadaps (*Erythrina lithosperma*) appears to give the best results.

1121 – **Irises Used in Scent-Making.** — BLIN, HENRI, in *Le Jardin*, Year XXVIII No. 659, pp. 230-231. Paris, August 5, 1914.

France does not produce sufficient iris rhizomes to supply the scent factory at Grasses (Alpes Maritimes), where 650 000 lbs. are required annually ; therefore there is a large importation of these roots from Tuscany. Further the Itatian product is of superior quality to the French. The writer is of opinion that iris cultivation might be extended in the South of France, and especially on the somewhat poor soil of the coast zone, which is not far from the centres of perfume manufacture.

The scent iris was grown for a long time in the Department of the Ain, in the communes of Anglefort and Carbonnot, near Seyssel. This crop has, however, decreased in importance owing to the competition of the South of France and of Italy. In 1903, the above-named communes produced from 33 000 to 35 000 lbs. of iris rhizomes, which fetched from 40 to 50*s* per cwt. The price has now fallen to about half this. Iris roots from Florence make 35 to 50*s* per cwt., while the less valuable ones from Verona are sold at 25 to 30*s*.

The varieties most used in scent-making are *Iris florentina* (*I. pallida*) and *I. Clio*, which is a variety of it. *Iris germanica*, which is coarser and hardier, grows wild throughout Provence.

The soil is prepared by digging, and fragments of the rhizomes are planted at 8 inches each way, towards the end of August and in September. They are hoed in spring and autumn. From 6 to 8 tons of manure are applied per acre to every crop, which occupies the ground for two or three years. In the South of France, good results are obtained by the application of 6 to 8 cwt. per acre of sesame or oil cake. The rhizomes are lifted at the end of the second or third year. The French crops vary from 20 to 36 cwt. of dry rhizomes per acre. An average crop of 28 cwt. per acre, fetching 28*s* per cwt., gives a gross return of £ 40 per acre.

The rhizomes are peeled, washed, dried in the sun and kept in a dry place. The old method of making the scent consisted in grinding the dry roots and thus obtaining iris powder (which is itself used for many purposes). The essence was distilled and the residual powder macerated in pure alcohol, either the essence or the maceration liquid being used. The better and more modern method is the process of extraction by means of volatile solvents such as dichlorethylene or trichlorethylene ; the latter is preferable for manufacture on a large scale.

1122 – **The Effect of Shading on the Transpiration and Assimilation of the Tobacco Plant in Cuba.** — HASSELBRING, HEINRICH, in *The Botanical Gazette*, Vol. LVII, No. 4, pp. 257-286, + 1 fig. Chicago, Ill., 1914.

The experiments described in this paper were undertaken in the year 1908-09 at the Cuban Agricultural Experiment Station at Santiago de las Vegas (Western Cuba) with the object of determining the effect on transpiration and assimilation in the tobacco plant of the cheese-cloth shade which is frequently used in that region for shading tobacco. This cheese cloth is a kind of network of coarse thread with meshes about a tenth of an inch wide ; during the middle of the day this cloth casts a barely

perceptible shadow, which, however, is more noticeable early in the morning or late in the afternoon.

Six tobacco plants were grown in vessels in the open, and six under cheese-cloth shade. The light intensity under the two conditions was measured by the photometric method. The temperatures were recorded by thermographs; the relative humidity and rainfall were also determined.

It was observed that:

1. The shade of the cheese-cloth tent reduced the total light by about one-third, but the diffuse light showed very little difference on bright days; when, however, there was no bright sun the total light (all diffuse) was reduced by about one-third.

2. There was no marked difference between the temperature within the tent and that outside. The average daily excess of the temperature outside the tent over that inside was, for 60 days, 0.14° F. It seems that the tendency of the tent to retain heat is balanced by the smaller quantity of radiant energy which passes into it.

3. The relative humidity is higher inside the tent than outside, the difference being more marked during the day, for at night in both stations it reaches 100 per cent. During the day the difference is enhanced by the partial retention of the moisture transpired by the plant.

4. The rate of evaporation is greater in the open than under the tent. The difference in the rates of evaporation in the two stations increases with the development of the plants and the consequent increase in relative humidity under the cheese-cloth. Besides diminishing the amount of light and increasing the relative humidity, the tent reduces the currents of air; all these changes tend to diminish transpiration.

The plants used in this work were grown from seed obtained from a single self-fertlilized mother-plant of a pure strain.

The shade plants attained a nearly uniform height of 6 ft. 10 in., while the height of the sun plants averaged about 5 ft. 9 in. The leaves of the shade plants were much larger and thinner than those of the sun plants and the internodes of the stem were longer. In 60 days the plants in the open transpired an average of 45.539 litres of water per plant and required 241.72 cc. of transpired water per gram of water-free substance produced, while the corresponding figures for the shade plants were 35.212 litres and 186.90 cc. The sun plants thus transpired on the average about 30 per cent more water per plant than the shade plants, while the average weight of dry matter produced was, in the mature plants, nearly the same in both sets. It follows that the series having the higher total transpiration also has the highest transpiration per gram of dry plant substance. This is corroborated by the above figures. The quantity of water transpired per unit of dry matter produced is remarkably uniform for the plants within each group. This confirms the conclusion that under the same aerial conditions the quantity of water transpired per unit of dry matter produced is constant and independent of the nature of the nutritive solutions or of their concentration or of the state of development of the plant.

The other observations gave the following averages per plant:

	Plants in the open	Plants shade
Leaf area, in square centimetres	21 442	29 442
Transpiration, total for the last five days, in cc.	10 566	7 862
» hourly per sq. decimeter leaf surface, in cc.	0.412	0.224
Fresh weight, in grams:		
leaves	401	469
stems	380	489
roots	212	205
total	993	1162
Weight of water-free substance of plants (at 78° C. and at a pressure of 6 cm. mercury) in grams		
leaves	74.50	66.94
stems	68.66	79.68
roots	45.26	41.51
total	188.42	188.14
Percentage of water.		
leaves	81.39	85.68
stems	81.91	83.71
roots	78.59	79.70
total	81.01	83.82

After a discussion of the observations and opinions of the most competent authorities on the subject of the relation between transpiration and production of plant substance, the writer draws the following conclusions:

Under the climatic conditions of Western Cuba the transpiration of tobacco plants grown in the open ground is nearly 30 per cent greater than that of plants grown under the cheese-cloth shade commonly used for shading tobacco in that region. The transpiration per unit area of leaf surface is nearly twice as great in the sun plants as in the shade plants.

The shading of tobacco plants by this grade of cheese-cloth does not seem to result in a diminished production of total plant substance by the shaded plants, as compared with other like plants not shaded. Since, however, the leaves of the shade-grown plants have a much greater total area than those of the plants grown in the open, it is evident that the quantity of plant material elaborated per unit of leaf area is greater in the plants grown in the open.

Although the total production of dry plant substance is not influenced in any marked degree by the cheese-cloth shade, the distribution of this substance is affected in such a manner that in the shade-grown plants relatively less material is deposited in the leaves and more in the stems than in the corresponding organs of the plants grown in full light. No evident influence is exerted om the deposition of material in the roots.

1123 – **Medicinal Plants in South Africa.** — SCHÖNLAND, S., (Professor of Botany, Rhodes University College) in *The Agricultural Journal of the Union of South Africa*, Vol. VIII, No. 2, pp. 201-205. Pretoria, August 1914.

In South Africa the native medical practitioners make use of a number of local plants; very few of these, however, are included in the official phar-

macopoeia. Among these the following wild plants may be mentioned: *Brassica nigra*, which is widely spread in South Africa; *Cannabis sativa*; several species of *Cassia; Datura Stramonium*; *Foeniculum vulgare*, *Marrubium vulgare*; several native species of *Polygala*, which appear to be at least as good as *P. Senega*; *Ricinus communis*, etc.

Numerous other medicinal plants have been grown here and there in South Africa, but rather for experimental or ornamental purposes and without attaining any commercial importance. Among these the following have been successful: *Aloe* (Barbados) at Grahamstown and Capetown; *Aspidium athamanticum* Kze, which is said to be superior to male fern, at Salem; *Carum Carvi* near East London; *Cassia marilandica* at Komgha; *Cinnamomum Cassia* at Durban and Maritzburg; *Convolvulus Scammonia* at Somerset East; *Coriandrum sativum* near East London; *Curcuma longa* in Natal; *Digitalis purpurea* in Albany; *Erythroxylon coca* in Natal; *Glycyrrhiza glabra* near East London; *Illicium verum* in a garden at Komgha as an ornamental plant; *Linum usitatissimum;* it grows freely at Komgha and Kei River, and has been very successfully grown near East London and in Lower Albany; *Matricaria Chamomilla*, grows freely at Komgha and was grown at Salem for many years; *Menta piperita*, successfully grown in several localities; *Pimpinella Anisum* near East London; *Pyrethrum* spp. have been grown very successfully for local consumption in South-east Cape Colony; *Rheum officinale*, successful at Komgha; *Tamarindus indica*, grows freely at Komgha, also grown at Durban, where it does not bear pods freely enough to make it worth cultivating; *Taraxacum officinale*, near East London.

Considering the special economic conditions of South Africa and especially that labour is expensive, mostly unskilled and unreliable, the writer does not believe that an important export trade in medicinal plants could be built up, even with those abundantly growing wild.

MARKET GARDENING

1124 — **Market Gardening in Spain.** — ZULUETA, José (Report presented to the VIII « Curso Internacional de Espansión Commercial ») in *Resumen de Agricultura*, Year XXVI, Part 309, pp. 390-398. Barcelona, September 1914.

The exportation of market-garden produce from Spain is continually increasing with the improvement of the means of communication. According to the last available official statistics, those of 1912, the exports during that year were as follows:

	£
Onions	624 873
Preserved vegetables	370 550
Potatoes	278 270
Chillies, ground and unground	181 315
Garlic	87 908
Tomatoes	37 382
Peas	10 930
Artichokes	650
Capsicums	159
Asparagus	29
Various vegetables	9 583

The statistics estimate the value of the annual vegetable production of Spain at 15 millions sterling. The writer, however, considers that this estimate falls far short of the reality, seeing that vegetables form the principal articles of food of the people. The above figures do not include all the vegetables consumed by the producers. Very many families possess kitchen gardens; even agricultural labourers and some towns-folk and factory hands possess them.

With the exception of Madrid, where the scarcity of water in the Manzanares precludes irrigation, all the large centres of population in Spain are surrounded by belts of market gardens. In the central "meseta" (plain), the first place is occupied by Aranjuez, with its 30 000 acres of well irrigated land thickly covered with market gardens and associated fruit plantations. In Aragon the irrigated land of Calatayud is noted; however, both in this district and in the "vegas" (fertile, gentle irrigated slopes at the foot of the mountains) of Saragossa, sugar-beets and lucerne predominate, so that market gardening has little commercial importance. The valley of the Ebro is only to a limited extent under intensive cultivation; however, Logroño Haro should be singled out, as it supplies a large preserve trade.

The typical market-garden zone which produces early outdoor vegetables, is the coast zone of the Mediterranean. From the town of Mataró the "huerta" (irrigated fruit and vegetable garden), extending as a long narrow belt along the coast from the suburbs of Barcellona to the French frontier, takes its name. Its speciality is in early potatoes, which are planted in November or December, and forced by the application of an abundant supply of manure; these potatoes are sent, in constantly increasing quantities to Paris and to England and elsewhere at a time when the tubers are still green. The annual exportation is estimated at 33 million lbs,, and its value at £120 000; but the price varies very much according to the greater or less competition of the products of other warm countries. The exportation of green peas is estimated at 3 ½ million lbs., with an average value of £12 000; these are grown without irrigation between rows of vines. In the "huerta" of Mataró no fruit trees are grown, while the more extensive plain of the Llobregat, which occupies the whole delta and extends some miles up the valley, is an uninterrupted fruit plantation, with vegetables below the trees.

According to official data, which, however, fall below the actual figures, the province of Barcelona possesses 16 200 acres of market gardens, of which the produce is worth £1 290 000. The name of "huerta" is not given to the cultivated zone extending between Rens and Tarragona; nevertheless the scanty water supply available is turned to such good account, that large crops of vegetables are also obtained there. The "huerta" proper commences in the Castellón plain and includes all the ancient kingdom of Valencia, where it reaches its greatest perfection. The Villareal "huerta", which now comprises about 2500 acres, uses subterranean water brought to the surface from a depth of about 200 ft. by means of Artesian wells with mechanical motor pumps. On an

average there is one well for every 57 acres of land, which is for the most part under citrus groves. The soil was prepared according to the system used in Santa Cruz (Teneriffe) in preparing the land for the celebrated Canary tomatoes: the solid rock is blown up with dynamite, the layer of earth beneath is extracted, the cavity is lined with fragments of rock and filled up with soil. At Villareal, however, the soil was transported for a long distance in order to obtain a layer 20 in. deep. The same thing is done at Almeria in order that the roots of the famous vines can penetrate deep into the soil and thus resist the drought. In the "huerta" of Valencia the cultivation is so intensive that there are families living upon little over an acre of land.

The "huerta" of Murcia is distinguished by the cultivation of capsicum. Vegetables are grown there in trenches covered during the winter with straw matting. Orihuela, Denia, Gandía, the "vega" of Granada and Motril are all important horticultural centres. The Motril zone is especially characterised by the cultivation of cotton and sugarcane.

The prices of "huerta" in full production are exceedingly high, rents amounting to £10 or £16 per acre and sale prices usually to £200 to £300 per acre. At Carcagente, Alcira and Gandía, citrus groves fetch as much as from £650 to £800 per acre.

As a rule, the ground is leased to families of colonists who usually do all the work; day labourers are very rarely employed. The management of the soil and the crops is carried out with the greatest exactitude.

1125 – **A Kaki Classification.** — HUME, HAROLD H., in *The Journal of Heredity*, Vol. V No. 9., pp. 400-406 + 6 figs. Washington, September 1914. FRUIT GROWING

As long as any kind of fruit is represented by only a few varieties the botanical classification can be followed, but when the number of varieties increases considerably, it becomes necessary for the pomologist to introduce some system of classification based on some well-marked characteristic in order to facilitate identification and handling.

Such is the case with the Kaki (*Diospyros Kaki*) of which the number of varieties grown in the United States for many years has been quite limited. But recently a very large number of new varieties have been introduced from China, Japan, Algeria, France, etc.

The writer is of opinion that the flesh characters form a satisfactory basis of classification. In the final analysis the flesh characters are fixed by the pollination factor and this factor finds its most striking expression in the colour and texture of the flesh.

All the varieties of *D. Kaki* known in America at this time are light fleshed when seedless, while certain varieties always show darkening of the flesh when seeds are present and other varieties are always light fleshed when containing seeds. Thus far in the writer's experiments parthenogenesis, that is the formation of seeds without pollination, does not occur in *D Kaki*, and if it does it is so rare as to have no practical importance. In *D. virginiana* it is said to have been observed in some instances, but it has not been proved experimentally.

Kakis may be divided from the pomologist's point of view into at least two groups — first those which show no change in colour under the influence of pollination, and second those in which the flesh of the fruit is darkened under the influence of pollination.

Since the change in colour in the one case is directly due to pollination and in the other pollination has no effect, those varieties which undergo no change in color are called *Pollination Constants* and those which are light coloured when seedless and dark coloured when containing seed are called *Pollination Variants*. If varieties which are constantly dark fleshed whether seedy or seedless should be found, they would belong to the group of *Pollination Constants*, which would be divided into two groups of light and dark fleshed Pollination Constants. It is hardly probable that there are varieties which are dark fleshed when seedless and light fleshed when seedy.

The varieties known at this time are divided as follows :

Group I, *Pollination constants*, Costata, Hachiya, Lienha, New Sien, Ormond, Phelps Siang, Tamopan, Tanenashi, Triumph, Tsuru.

Group II, *Pollination Variants :* Dai Dai Maru, Gailey, Godbey, Hyakusae, Lonestar, Masugata, Myotan, Nectar, Okame, Taber No. 23, Taber N. 129, Yeddoichi, Yemon, Zengi.

The amount of dark flesh found in fruits of varieties of the group *Pollination Variants* depends both upon the number of seeds and upon their location with reference to one another : It is partial or arranged round the seeds when only one or two close to each other are present ; if two seeds are present diametrically opposite one another, or if there are more than two seeds, the whole area may be more or less darkened.

Associated with the changes in the colour of the flesh there are well marked variations in time of ripening, shape and size of fruits, quality and texture of flesh.

Considering the extraordinary variability shown by *D. Kaki* due to cultivation, it is not improbable that the present cultivated varieties are derived from two distinct species.

Certain varieties of kakis bear both staminate and pistillate flowers. Some of those which bear staminate flowers do so every time the tree blooms, while other varieties are very irregular in this particular. The first class of staminate trees are designated as *Staminate Constants*, while the second class may be called *Staminate Sporadics*. Those which produce only pistillate flowers may be referred to as *Pistillate Constants*. It is interesting to note that staminate-flowering varieties of both classes are more commonly found among the *Pollination Variants* than among the *Pollination Constants*. To the former group belong Gailey, Masugata, Okame, Taber Nos. 23 and 129. Among the *Pollination Constants* only two staminate-flowering sorts, *viz.* New Sien and Siang, have so far been found. It is not improbable that they belong to a different species from the other varieties or at least a different section of *D. Kaki*. These two varieties were recently introduced from Northern China. It must be borne in mind that *D. Kaki* is not native to Japan, but was introduced from China several centuries ago ; no

doubt the two groups (light-fleshed and dark-fleshed) have diverged greatly, even granting that they were originally one.

The different varieties so far studied may be grouped on the flowering habit as follows:

Group I: *Pistillate Constants*. Tanenashi, Hachiya, Costata, Tsuru, Tamopan, Hyakume, Yenon, Yeddoichi, Phelps, Triumph, Zengi.

Group II: *Staminate Constants*. Gailey, and probably Masugata, Siang (S. P. J. No. 21910 and S. P. J. No. 27037).

Group III: *Staminate Sporadics*. Okame, Taber No. 23, Taber No. 129.

Experiments conducted by the writer tend to prove that it is possible by selection to transform strains of staminate sporadics into staminate constants.

1126 – **The Siamese Seedless Pomelo.** — BOYLE, H. H. (Bureau of Agriculture, Manila, P. I.) in *The Journal of Heredity*, Vol. V, No. 10, pp. 440-444 + 1 fig. Washington, October 1914.

In 1902 the Office of Foreign Seed and Plant Introduction of the U. S. Department of Agriculture introduced from Bangkok some plants of the Siamese pomelo which had been described as seedless. But the only plant which reached Washington alive produced fruit which contained many seeds and was decidedly inferior; it was consequently destroyed.

In 1912 the writer was sent by the Philippine Bureau of Agriculture to Siam to study the seedless pomelo on the spot and to obtain plants of it. He was able to find it about 30 miles to the north-east of Bangkok and in the Nakon Chaisii district, which produces the best pomelos. He found that some trees bore only seedless fruit, but some also bore fruit with seeds, especially those trees which stood on the side of the grove nearest the ordinary seminiferous pomelo trees; the presence of seeds was apparently due to cross-pollination. The seedless pomelos are all propagated by marcottage by the natives, to whom budding in unknown. In research work carried on in the United States it had already been observed that the seedless navel orange bore seeds when crossed by pomelo.

The writer classifies the seedless pomelos of the Nakon Chaisii district according to four types:

1. Medium size, 4 ½ inches in diameter by 5 inches in length; colour light yellow; flesh white; taste very aromatic, free from bitterness.

2. Medium size, 4 7/8 inches in diameter by 3 ¼ in length; colour bright yellow; flesh white; taste aromatic and excellent.

3. Medium size, about the same as No. 1, pyriform; colour orange yellow; flesh pinkish white; taste good, rather heavy.

4. Size very large; colour yellow; flesh deep pink; taste bitter.

Type 1 is the finest of all, Types 2 and 3 are the commonest, while Type 4 is inferior to the others.

The Siamese seedless pomelo has been introduced into the Philippines and into the United States.

1127 – ***Prosopis juliflora*, the Mesquite or Algaroba Tree, and *Prosopis pubescens*, the Screw Bean.** — ROBERTSON, C. C. (Research Officer, Forest Department) in *The Agricultural Journal of the Union of South Africa*, Vol. VIII, No. 2, pp. 233-239. Pretoria, August 1914.

The Mesquite or Algaroba and the Screw Bean or Screw Pod Mesquite deserve to be introduced and grown for their pods, which are excellent fodder for live stock.

Prosopis juliflora, the mesquite, is widely distributed in North America from Western Kansas to California and southwards into Mexico, and probably various forms occurring in Central and South America and there known as algaroba should be included in the same species. Even in the United States the species varies a good deal, and two extreme forms, the varieties *glandulosa* and *velutina*, are recognized.

The mature pods are yellow, or often tinged with red, and are about four to nine inches long and one-third of an inch wide, and contain about six to twenty seeds embedded in pulp.

In its home in North America, *Prosopis juliflora* is found in the hotter, drier parts of the country, where the average annual rainfall is about 25 inches; it occurs even in arid localities where the rainfall is as low as 10 inches. It develops a remarkbly long taproot, which enables it to derive moisture from a great depth and to become independent of the surface water supply. It grows to a height of from 3 to 20 feet. The *velutina* variety reaches its greatest height of about 40 feet and a diameter of 1 ½ or 2 feet in the valleys of Southern Arizona. The species is said to be extending its range naturally in some of the prairie States, and in California it will grow on soils containing a large proportion of carbonate of soda.

Prosopis juliflora has been naturalized in several countries. It is abundant in the drier parts of the island of Jamaica, where it grows in dry gravelly soils. In the Hawaiian Islands it has spread rapidly since its introduction about 70 years ago and now covers an area of at least 50 000 acres on the south and west coasts, where it is protected from the trade winds. It grows on gravelly soils and steep stony slopes, occupying land which is worthless for other purposes.

In some of the drier parts of India, *Prosopis juliflora* is now naturalized and has proved extremely hardy to drought and is used for reforesting dry, waste lands and for arresting drift-sands. The tree is also said to be naturalized in the Philippine Islands and in Australia.

In German West Africa it was introduced about thirteen years ago and seems to withstand the drought well and to grow on poor soil.

Seed of *Prosopis* and its vareties has been imported from different sources by the Forest Department of the Union of South Africa at intervals during the last seventeen years. It seems to thrive in the different localities in which it has been planted, but its growth has been somewhat slow and bushy, and the writer recommends it for hedges and for arresting sand-dunes.

Wherever it has been introduced it is extending its range naturally by regeneration from seed which is disseminated by stock in their droppings. It is of slow growth. Its wood is heavy, hard and close-grained.

t has been used for railway sleepers, wood-paving, fence-posts and furiture. It is an excellent firewood and makes good charcoal. The flowers re eagerly sought by bees. The pods are relished by cattle, horses and igs and form an important stand-by for times of drought. About 53 er cent of their weight is nutritious and consists of vegetable albumen, um, grape-sugar, with traces of fat and salts.

The Mexicans and Indians grind the pods into a coarse flour which hey bake into cakes for food. In the Argentine a liquor is distilled from he pods.

Prosopis pubescens is distinguished from the other mesquite by its ods, which are twisted into a spiral. Its wood is similar to that of *P. juliflora*. The pods, although nutritious and used for fodder in America, are of less value because of their smaller size. This species has also been successfully introduced into South Africa.

1128 – **The Jaboticaba (*Myrciaria*).** — POPENOE, WILSON (Agricultural Explorer, U. S. Department of Agriculture), in *The Journal of Heredity*, Vol. V, No. 7, pp. 318-326. Washington, D. C., July 1914.

The jaboticaba is a fruit tree belonging to the Myrtaceae, indigenous to central and southern Brazil. Berg distinguished three species: *Myrciaria cauliflora*, *M. Jaboticaba* and *M. trunciflora*; but they are not distinguishable with certainty, at any rate under cultivation.

The tree, which is evergreen, may reach 30 to 40 ft. in height; it branches from the ground, producing an almost spherical crown. The fruits are borne on the branches from the ground-level to their tips; they are nearly sessile in *M. cauliflora*, but in *M. Jaboticaba* are produced on slender peduncles less than an inch long; they ripen within two or three months of the flowering -period, and a tree may flower and fruit several times during the year. In appearance the fruits rather resemble large grapes, reaching 1 in. or more in diameter in *M. cauliflora*; the most usual colour is a deep maroon purple; the skin contains tannin and is rejected, while the pulp is translucent and juicy, in flavour something like grapes; each fruit contains from one to four seeds.

The jaboticaba will not stand more than the lightest frosts; it seems to prefer a rich, deep soil. The trees should be planted 30 ft. apart; when grown from seed (which is the usual method of propagation) they require six to eight years to come into bearing.

1129 – **Manurial Experiments on Coconuts at Peradeniya.** — BAMBER, M. KELWAY. in *Department of Agriculture, Ceylon, Bulletin* No. 10, pp. 135-146. Colombo, May 1914.

These experiments were conducted, to determine the effect of manurial constituents, alone and in combination, on the development and formation of nuts and to what extent old coconut palms can be improved by means available to most cultivators. The trees used were all old, growing on a quartzy loam at an elevation of about 1600 feet and about 51 miles from the sea in a direct line. The rainfall of the district varied between 62.37 inches in 1908 and 120.70 inches in 1913 and averaged 83.35 inches.

The results tend to show that:

1). Ploughing twice a year is as beneficial as manuring.

2). Tying cattle to the trees in 1911 and 1912 had an immediate effect lasting over two years.

3). The application of a soluble manure twice annually and a general manure annually produced a steady increase which was maintained during 1913.

4). Green manure with basic slag and sulphate of potash showed a marked improvement, which, however, was not fully maintained during the wet season of 1913.

5). The application of salt (NaCl) or nitrate of soda has had no beneficial effect during the years of the experiment.

6). No treatment of any kind results in a gradual falling off in yield.

7). The effect of cultivation and manuring has not so far decreased the number of immature nuts (1) falling annually.

8). The number of mature and immature nuts increased annually. while the proportion of female flowers producing mature fruit showed a steady decrease during the same period.

9). The reduction of the percentage of mature nuts to female flowers is rather more marked in the manured plots than in the unmanured, but the percentage increase of total female flowers is more marked in the unmanured plots.

1130 – **The Manuring of Bananas** (2). — BRÜNNICH, J. C. (Chemist of the Department of Agriculture and Stock, Queensland) in *The Queensland Agricultural Journal*, Vol. II, Part 2, pp. 132-141. Brisbane, August 1914.

Hitherto, in general, large areas under bananas have been for years continually cropped, without any attention to manuring, and abandoned when the crop, became unprofitable owing to exhaustion of the soil.

In the State of Queensland it was found that the abandoned banana lands were eminently suitable to other crops and more particularly sugarcane, and thus the great waste of leaving stretches of land uncultivated was avoided, but the production of bananas, which in 1898 had been 4 ½ million bunches, dropped to an average yield of a little over one million bunches in the last few years.

Several manurial experiments carried out in Southern Queensland under sub-tropical conditions, gave excellent results and demonstrated that exhausted banana lands may, by thorough cultivation and heavy dressings ot fertilizers, produce crops equalling those obtained from virgin lands, provided that they be in good physical condition, and above all, contain a fair amount of humus. From what has been written about bananas in different countries it appears that they require a well drained loamy soil, containing a fair amount of humus, and good amounts of potash, lime and phosphoric acid in readily available form.

With regard to the conservation of humus, a good deal is returned to the soil by the rotting of the stalks on the ground after the bunches

(1) See also No. 248, *B.* March 1914. (*Ed.*).
(2) See also No. 1278, *B.* Sept. 1912. (*Ed.*).

have been cut. The growing of green manure crops like velvet beans, Mauritius beans, etc., is practised in some localities and can be strongly recommended.

No other cultivated plant exhausts the soil to such an extent as bananas. This is fully borne out by the following analyses carried out in the Queensland Departmental chemical laboratory, on virgin soil and exhausted banana land, both taken from Buderim Mountain, where the soil is a volcanic sandy loam.

	Virgin soil per cent.	Exhausted land per cent.
Humus and other organic matter	18.86	17.04
Nitrogen	0.560	0.292
Lime	0.450	0.180
Potash	0.109	0.067
Phosphoric acid, soluble in 1 per cent. citric acid	0.0142	0.0634

This is confirmed also by analyses, made in the same laboratory, of the fruit and of different parts of the plant of three varieties of bananas. They show that a fair crop of Cavendish bananas (555 bunches per acre, weight of bunch 39 lbs.) removes in the fruit 123 lbs. of potash, 12½ lbs. of phosphoric acid and 43.7 lbs. of nitrogen, whilst the stalks left on the ground contain 150 lbs. of potash, 6 lbs. of phosphoric acid and 41.4 lbs. of nitrogen. Practically speaking therefore 273 lbs. of potash, or about 5 cwt. of sulphate of potash per acre, must be available to the banana plant in a readily assimilable form to produce its growth and crop in a few months.

In the manuring experiments conducted by the writer on Buderim Mountain, 160 lbs. of potash, 80 lbs. of phosphoric acid and 40 lbs. of nitrogen per acre were applied to normal crops and in double quantities to the exhausted lands, the composition of which is given above.

The unmanured and lightly manured experiments showed the want of vigour in the plants; the banana sucker, as soon as the bunch appears, seems to lose its vitality; the leaves drop off and the stalk bends over and often breaks under the weight of the small bunch. On the other hand the heavily manured plots produce good heavy bunches and the plants withstand better the cold weather during the winter.

In some cases very heavy manuring was tried, as much as two tons of artificials being given yearly, at a cost of £ 25 per acre, and, in the plots where lime was applied, attaining £ 29 per acre.

The average yield of the eight experimental plots (K P. N, see Table) for three years was 345 bunches with 3035 dozens of bananas per acre per annum, valued £ 38, the artificial fertiliser costing annually about £ 12 10s.

In the experiments 2 (K P N) the average yield was 457 bunches, with 4330 dozens of a value of £ 54 per acre, showing an increased net profit over the yield obtained from the preceding plots.

These experiments further showed that nitrogen acts best in form of dried blood and as nitrate of lime, that the addition of salt to the manure does not appear to make any appreciable difference, and that in the case of old plantations it is best to apply part of the artificials in holes made

Crop Results of Manuring Experiments on Buderim Mountain.

Number of Experiment	Fertilizers Used	Average yield per acre	
		No. of bunches	Dozens
1	K P N b	156	1 348
2	2 (K P N b)	243	1 900
3	½ (K P N b)	132	762
4	Nil	20	110
5	½ (K P Nn)	216	1 510
6	2 (K P Nn)	372	3 412
7	K P Nn	315	2 551
8	K Pt Na	221	1 937
9	2 (K P Na)	410	3 508
10	K Pt Na	350	3 118
11	2 (K P Nb)	388	3 266
12	2 (K P Nn)	471	4 237
13	2 (K P Nn) + salt	428	3 478
14	2 (K P Nb) + salt	410	3 347
15	Nil	273	1 760
16	Nil + lime	323	2 163
17	2 (K P Nn) + lime	388	3 322
18	2 (K P Nb) + lime	421	3 532
19	2 (K P Nn) + lime + salt	356	3 087
20	2 (K P Nb) + lime + salt	374	2 989

The figures of the first 10 experiments are averages of four years; those of the other of three years ending in 1914.

K = 160 lb. K_2O applied as 320 lb. potassium sulphate per acre.
Nb = 40 lb. N » » 290 lb. dried blood per acre.
Nn = 40 lb. N » » 290 lb. nitrate of lime per acre.
P = 40 lb. N » » 200 lb. ammonium sulphate per acre.
Pt = 80 lb. P_2O_5 » » 470 lb. superphosphates per acre.
2 (K P N) means double quantities; ½ (K P N) means half quantities.

All manures applied twice a year — in spring and autumn. Salt applied 2 cwt. per acre; lime applied in two dressings of 2 tons per acre.

with a crow-bar to a depth from 18 to 24 in. all round the banana stool at a distance of from 3 to 5 feet, and the rest as top dressing. Lastly, it appears that physical conditions of the soil are improved by cultivation and manuring.

In the close neighbourhood of the experimental plots other persons carried out some experiments which proved that manuring with insuf-

ficient potash yields disappointing results and that on virgin soil the application of the standard fertilizer mixture, K P N, gave the most profitable harvest, namely £62 2*s.* 3*d.* per acre.

The table includes the results obtained by the writer. The literature quoted in the paper mentions twelve works.

1131 – **A New Oak for Breeders: *Quercus insignis.*** — *The Journal of Heredity*, Vol. V, No. 9, pp. 406-407 + 1 plate. Washington, September 1914. FORESTRY

Dr. WILLIAM TRELEASE, of the University of Illinois, has called the attention of the American Genetic Association of Washington to *Quercus insignis*, and to the value it might have for hybridizing. The species in question was discovered in 1843 in the State of Vera Cruz, Mexico. It is found in considerable quantities about midway down the flanks of Mount Orizaba and especially near Chiapas. It is a rapid grower, attaining a height of 60 to 80 feet; its bearing is erect and it sends out large branches at the height of 30 or 40 feet from the ground. Its acorns are suitable as food for stock, and very large, usually two inches in diameter and sometimes two and a half. Their weigh is 50 to 60 grams each.

In view of its habitat the tree is probably unsuited to a temperate climate, but Dr. Purpus, who has explored its home, thinks that it could be raised in Florida, Cuba, Porto Rico, etc. The office of Foreign Seed and Plant Introduction of the U. S. Department of Agriculture is now endeavouring to introduce it and experiment it. If it is found to be well adapted, it is possible that native species of oaks could be grafted with it, thus yielding a large crop of acorns. Hybridizing experiments should also be made with some local species with a view to obtaining larger acorns.

Close relatives of *Q. insignis* are *Q. strombocarpa* of the same region and *Q. Skinneri* of Guatemala; the acorns of the latter, however, are presumably bitter or astringent.

1132 – **West Indian Boxwood.** — SPRAGUE, T. A., and BOODLE, L. A., in *Royal Botanic Gardens, Kew, Bulletin of Miscellaneous Information*, No. 6, pp. 214-219, London, 1914.

By means of specimens of flowering and leafy twigs sent to Kew by the British Consul at Caracas, Venezuela, it has been possible to identify the West Indian or Venezuelan boxwood as *Casearia praecox* Griseb. According to information supplied by the same Consul, West Indian boxwood is a product of the district of Maracaibo only, whence all that exported from other ports is originally shipped.

Boxwood is a yellowish hardwood, used mostly for turning. It is cut into pieces about 6 ft. long and from 4 to 8 inches thick. The best time for cutting the wood is from December to June.

Casearia praecox Griseb. had hitherto been recorded only from Cuba; it has, however, been collected also in the district of Santa Marta, Colombia, but under another name. The three forms (Cuban, Venezuelan and Colombian) differ so slightly in their characters and in the structure of their wood, that they may be considered as varieties belonging to the same species.

There are also other species of *Casearia* which yield useful wood.

1133 – **Experiments on the Grazing of Woodlands.** — ZEDERBAUER, E., in *Mitteilungen aus dem forstlichen Versuchswesen Oesterreichs*, Part XXXVIII, pp. 78-83. Vienna, 1914.

By ministerial decree of March 30, 1888, the Royal Institute of Experimental Forestry established a scheme of experiments on the influence of pasturage on woods, planned to ascertain : *a*) the losses of intermediate and direct products caused by pasturage in 1) plantations of spruce, 2) natural growths of spruce ; *b*) the nature and extent of the damage caused by the grazing and trampling of animals ; *c*) the measures to be taken to prevent damage to the wood, 1) of young trees transplanted and grown from seed. 2) of 3 and 4 year old trees from seed, 3) of 3 year old trees from seed, isolated, and in groups, 4) of 3 year old trees planted out in ordinary holes and with a small hoed area round them ; *d*) the most practical means, apart from fencing and hedging, of preventing damage by live stock, to 1) isolated trees with and without supports, 2) trees in groups with and without supports, 3) plantations without artificial protection.

This scheme of experiments was carried out in State forests and also in private forests. The results are summarised in the following table :

The effect of live stock in plantations with or without protection.

Period	Trees without protection		Trees with protection	
	Number	Height	Number	Height
		metre.		metre
a) *Plantations with* (1) *and without* (2) *enclosure :*				
1 May 1894	100	0.16	100	0.17
1 September 1909	12	1.55	61	1.62
2 May 1893	100	0.25–0.30	100	0.25–0.35
2 October 1899	45	0.5–0.7	63	0.7–1.0
b) *Trees not transplanted and transplanted :*				
June 1900	100	—	100	—
September 1911	14	0.81	21	0.64
c) *Trees with* (1) *and without* (2) *supports :*				
1 May 1894	100	—	100	—
1 September 1909	2.8	1.30	71	1.44
2 June 1895	100	—	100	—
2 September 1911	13	0.77	38	1.15

These results show that : 1) spruce plantations enclosed or with supports made a stronger growth than those without this protection ; 2) enclosed spruce plantations at 10 to 20 years contained about two-thirds

(61-63 per cent) of the original plants, whilst plantations without enclosure had only 12 to 45 per cent ; 3) 20-year plantations of spruces protected by supports contain 38 to 71 per cent of the original trees, as against 3 to 13 per cent in plantations without supports ; 4) 16-year stands of untransplanted spruces are less resistant to the movements of live stock than those of transplanted trees, while the differences in height are very slight ; 5) the expenditure incurred in enclosing or providing supports appears to be justifiable from a forestry as well as financial point of view. Protection by means of supports is also an advantage to pasturage.

LIVE STOCK AND BREEDING.

1134 — **The Hygienic Importance of Acid-Rennet Bacteria in the Udders of Cows.** — HYGIENE.
GORINI, COSTANTINO (Communication to the VI International Dairy Congress, Berne, June 1914), in *La Clinica veterinaria, Rassegna di Polizia sanitaria e di Igiene*, XXXVII Year, No. 17, pp. 47-51. Milan, September 1914.

In 1901 the writer showed the presence in the udders of cows, of acid-rennet producing bacteria (cocci causing coagulation by means of acid and rennet) which are generally found in the lactiferous ducts. Later he found some very small bacillus forms, which he called *Bacillus minimus mammae*.

These acid-rennet bacteria are capable of causing the premature coagulation of milk, *i. e.* before the normal acidity has developed, even immediately it is drawn from the udder and before external contamination.

They develop exceptionally in the lactiferous ducts, being probably favoured by the milk remaining in them after milking, and they cause inflammatory conditions of the udder or other complications. This inflammation differs from mastitis due to pyogenic or specific germs and usually disappears spontaneously, though it is liable to affect the quality and quantity of the milk.

The changes in the milk due to these organisms are very different from those caused by other bacteria and cannot be detected either by acidometric or by alcoholic methods, by boiling or by the reductase tests, etc. They are detected by zymoscopic or fermentation tests, which are also of great importance in judging the cheese-making value of a sample of milk and in detecting abnormal conditions of the udder.

The following practical conclusions may be drawn from these results :

1) To prevent the abnormal development of the acid-rennet microflora in the udder it is advisable to ensure that the cow is milked dry so as to empty completely the lactiferous ducts.

2) In zymoscopic testing of milk, the type of coagulum produced by the bacteria may be used as a guide by both cheese-maker and veterinary surgeon for indicating faulty milking and abnormal conditions of

the udder, which are as important to the health of the animal as to the quality of the dairy products(1).

1135 – **Poisoning by *Sorghum halepense*** (2). — *Royal Botanic Gardens, Kew, Bulletin of Miscellaneous Information*, No. 6, pp. 229-230. London, 1914.

Sorghum halepense is, after rice, probably the commonest food and fodder plant in India, besides being much used elsewhere; yet the constituents which are liable to exert a poisonous action are not well understood. It has therefore been deemed desirable to publish a note dealing with the matter.

In 1902 DUNSTAN and HENRY isolated a glucoside, which they called dhurrin, from the leaves of the great millet (*Sorghum vulgare*). This substance, on hydrolysis with hot hydrochloric acid or the enzyme emulsin, splits into prussic acid, parahydroxybenzaldehyde and dextrose. The enzyme emulsin is present in the parts of the plant containing the glucoside. *Sorghum halepense* Pers. (*Andropogon halepense* Brot). is considered by Hackel to be a variety of *S. vulgare* Pers. (*Andropogon Sorghum* Brot.) and there is little doubt that dhurrin is found in it as well as in the typical plant. The cases of poisoning observed are thus to be attributed to prussic acid produced by the hydrolysis of dhurrin in the stomachs of animals.

An examination of the numerous records of cases in which *Sorghum* was used as fodder, establishes two important facts: Firstly, the young vegetative parts of the plant are the most dangerous to stock, the mature plant being nearly or quite harmless; analyses of old plants have shown that little or no cyanogenetic substance was present. Secondly, the poisonous effect of the grass is enhanced in times of drought. One writer states that the grass is dangerous only in the green state and that when it is cut and dried and used for fodder it has no injurious effect. This may be due to the destruction of the glucoside or the emulsin or both, but it is possible that the grass was not cut till near maturity, that is after the disappearance of the glucoside.

1136 – **The Modifications produced in the Anthrax Bacterium by Means of Ultra-Violet Rays.** — Mme. VICTOR HENRÍ, in *Comptes Rendus hebdomadaires de l'Académie des Sciences*, Vol. 158, No. 14, pp. 1032-1035 + 12 figs.; Vol. 159, No. 4, pp. 346-348 + 6 figs. Paris, April 6 and July 27, 1914.

It is well known that ultra-violet rays cause the death of micro-organisms. M. and Mme. VICTOR HENRI have demonstrated that the abiotic effect of these rays is due to chemical reactions taking place in certain molecular aggregations which are to be found in the protoplasm, and especially in the cell nucleus. When the irradiation is weak, either in the case of the numerous micro-organisms studied by M. and Mme Henri or in that of the developing *Ascaris* eggs studied by FAURÉ-FREMIET, a series of more or less

(1) These conclusions, presented at the International Dairy Congress at Berne, June 1914 were adopted by the International Commission, which introduced zymoscopic testing for the study of the veterinary control of milk, in preference to all other tests (reductase, etc.) recommended for the laboratory control of milk. (*Ed.*).

(2) See also No. 1644, *B.* Dec. 1912, and No. 694, *B.* June 1913. (*Ed.*).

deep changes takes place. The fact that ultra-violet rays only attack certain chemical constituents of the cells, leaving all the rest intact, led the writer to believe that by regulating the irradiation, it would be possible to produce modifications in micro-organisms.

The writer exposed to ultra-violet rays an emulsion of sporogenetic anthrax 24 hours old in quartz tubes revolving round a lamp for 1, 2, 3, 5, 10, 20 and 40 minutes respectively, and then sowed 1 cc. on gelose and 1 cc. in broth. This treatment killed the greater number of the microbes, but some remained alive and capable of multiplying. A large number of the latter presented a normal aspect, but some colonies differed markedly. From these colonies, the writer has isolated a series of new forms distinct from normal anthrax in morphological, biochemical and biological characters. The character which is least stable under the action of the ultra-violet rays seems to be the uniting to form filaments. Further, the shape of the bacteria was changed (all forms being obtained, from bacilli to cocci), as well as their size (they became ½ or ⅓ the normal thickness), their sensibility to Gram's reagent (five forms being obtained which gave no reaction), and their pigmentation (two forms gave deep yellow cultures).

While the morphological and biochemical modifications produced in the cultures of bacteria grown in different media, *e. g.* in a medium containing sugar, are unstable and revert to the normal form on being transplanted to a normal nutritive medium, the morphological and biochemical modifications due to exposure to ultra-violet rays are distinguished by their great stability in successive artificial cultures.

On inoculating a guinea-pig with the modified form, the writer obtained in two cases from cultures of the blood from the spleen and liver, colonies with the characters of the normal anthrax bacteria. He therefore concludes that by passing into an animal organism the more modified, yellow, slender, Gram-negative form, which forms no spores, does not liquefy gelatine and has lost most of its virulence, can return almost to the primitive anthrax type.

1137 – **Pyroplasmosis in Cattle in Hungary in 1913: Means of Control.** — WOLLÁK, KÁROLY, in *Allatorvosi Lapok*, Year XXXVII, No. 33, pp. 387-389. Budapest, August 15, 1914.

In Hungary haemoglobinuria in cattle is relatively rare and seems to be restricted to the wooded regions of the North-East (1). Of late years, however, this disease has also appeared in the country on the left bank of the Tisza, where it sometimes takes a virulent form.

In 1913 pyroplasmosis appeared for the first time on May 20, in the commune of Hajduhadház (Hajdu county), and raged in a herd of 137 head of cattle which were grazing on some slightly elevated ground covered with oaks and robinias.

The writer describes the evolution of the disease and classes the symptoms observed into four groups according to the organs most affected. On the bodies of the diseased animals, the greatest number of ticks was found

(*Ed.*)

(1) See No. 353, *B.* March 1914.

at the end of May, whilst towards the middle of June their number diminished and the disease also began to disappear. As the disease had caused, in a relatively short time, considerable losses (by June 1, 10 animals had perished), in order to prevent its spreading, the writer subjected the herd to examination and then to treatment. Of the remaining 127 head, 30 were still affected and 97 were apparently healthy. The herd was removed from the infected spot and the 30 affected animals were isolated and kept in a stable ; 7 among them were kept as controls and the others were subjected for ten days running to arsenical treatment. They were given every day, in a small ration of bran, the following mixture : 1 gm. of powdered arsenious acid ; 10 gms. of powdered *calamus* root ; 10 gms. of sulphate of iron. The bodies of the diseased animals were freed from ticks and the skin was washed with a 5 per cent creoline solution. Already after the first and second treatment it was observed that the animals regained their appetite ; their urine presented its normal colour, and the weight of the animals perceptibly increased. The 23 animals under treatment were all cured, whilst among the 7 controls, 1 died and 2 had to be slaughtered.

In the herd which had been removed from the infected spot, 25 animals fell ill. In two cows the disease took a rather mild form, but with symptoms that the writer had never before observed in the symptomatology of pyroplasmosis. During the examination one of the cows used to let itself fall on its knees and remained a length of time in that position, while the other crossed its front legs ; the disease appeared in these two cases under nervous forms, and as the urine emitted was not red but of a deep yellow, the diagnosis was rendered more difficult. Here also arsenic showed its beneficial effects. The useful action of arsenic observed in destroying parasitical protozoa (*Spirochaetes*, *Trypanosomes*) leads the writer to hope that this substance, in the form of powder, will be a valuable means of controlling pyroplasmosis, especially as arsenic acts favourably on metabolism and on the increase of weight. Further experiments will decide whether the use of the new arsenical preparations, (salvarsan and neosalvarsan) can be practically recommended for cattle attacked by pyroplasmosis.

1138 – **Preventive Inoculations against Sheep and Swine Pox.** — Pécsi, Dani, in *Allatorvosi Lapok*, Year XXXVII, Nos. 30, 31, 32, pp. 357-359, 369-370, 381-382 + 2 figs. Budapest, July 25, August 1 and 8, 1914.

The present is a study intended to afford Hungarian farmers information on sheep and swine pox (1) and on the means of controlling this disease. The writer mentions the works of numerous investigators who have sought to find a harmless virus which would ensure the active immunity of sheep. Chaumiers, Voigt and others again have endeavoured to attenuate the activity of the variolous virus by passing it through an animal organism, so as to obtain a curative serum.

The writer, who has studied the question for the last 29 years, relates

(1) See No. 536, *B.* June 1914. (*Ed.*).

his experiments during 1913, made with virus attenuated by passing through calves, which have not given a definite result because calf-pox inoculated into sheep gave only 50 per cent. of immunity.

The study is completed by a report of a series of remarkable experiments by BRIDRÉ and BOQUET (1). Encouraged by the results of BESREDKA'S (2) discovery on the properties of sensibilised virus, they proceeded, by the application of this discovery, to modify the variolous virus in its activity by a contact of a certain duration with anti-variolous serum, or in other words to transform it, by sensibilising it, into vaccine. The experiments have had considerable results. The animals that were vaccinated with the sensibilised virus did not contract the disease and acquired in two to six days after the injection an absolute immunity. This immunity is very constant, and the vaccinated sheep did not prove at all dangerous to the untreated animals with which they were left in permanent contact. The injection must be made under the skin of the thorax behind the elbow; it causes generally, after four or six days, the formation of an oedema of variable size attaining sometimes that of a hen's egg, which is resorbed after a few days, leaving a hard spot which gradually disappears. The local reaction following on the subcutaneous injection of sensibilised virus varies in intensity according to the age of the animals. It is very slight in sucklings, more marked in lambs eight to ten months old and strongest in grown up sheep. Even when the local reaction fails, vaccination produces active immunity. In some especially sensitive animals, four or five days after the injection an increase of temperature sets in, which, however, is independent of the degree of local reactions. Vaccination does not cause any trouble in the physiological condition of the animals. Ewes in lamb or during lactation may be vaccinated without any danger of abortion or decrease of milk yield. Vaccination practised on sheep during the period of incubation of variola, has no unfavourable effect on the evolution of the disease. Anti-pox vaccination is thus applicable in contaminated surroundings, to all apparently healthy subjects. The really sound animals will acquire immunity and those that are already infected will undergo the disease as usual. In 1913 in Algeria 1 245 000 sheep were treated with this serum and not a single accident occurred.

MM. BRIDRÉ and BOQUET placed at the disposal of the writer a small quantity of sensibilised virus with which to experiment upon Hungarian sheep. The tests were made on ten lambs from four to six months old, of which two were kept as controls and the rest vaccinated as follows: two received the prescribed dose (0.2 cc) ; four were given half the dose and two a quarter ; five days after vaccination all the vaccinated animals showed, at the spot where the injection had been made, oedemae of different sizes. In one of the animals the temperature curve showed a maximum of 41.8° C.,

(1) Vaccination contre la clavelée par virus sensibilisé. — *Annales de l'Institut Pasteur*, No. 10, October 1913.

(2) De la vaccination par virus sensibilisé. — *Bull. de l'Institut Pasteur*, 1910, p. 241. 1912, p. 529.

whilst in the others it did not attain 41°C. The quantity of lymph used had no influence on the effect of the vaccination. The controls did not show any change, their temperature remaining unvaried at 39° C. Eight days after vaccination all the animals were infected with pox; five days after infection the two controls presented, at the infected spot, an inflammation which developed after four days into a pustule the size of a pigeon's egg, while the animals vaccinated with the sensibilised virus remained perfectly immune. The spots caused by the infection had disappeared.

Sheep breeding has greatly benefited by the researches of M. M. BRIDRÉ and BOQUET, who have solved the vaccination problem: namely *they have conferred an active, efficient and lasting immunity to sheep against sheep pox, by the inoculation of virus which is harmless to the animals inoculated, and incapable of producing contagious lesions.*

The writer warmly recommends the use of antipox serum, thanks to which sheep breeding in Hungary will be gradually freed from its greatest enemy.

1139 – **Studies on Fowl Cholera: The Inheritance in Rabbits of Immunity to Infection with the Bacterium of Fowl Cholera.** — HADLEY, PHILIP B., in *Agricultural Experiment Station of the Rhode Island State College, Bulletin* 157, pp. 285-307. Kingston, N. Y., April 1914.

The present paper is the writer's third contribution to the study of fowl cholera. In the first ("Fowl Cholera and Methods of Combating it", Bulletin 144, *Agricultural Experiment Station of the Rhode Island State College*) the writer announces the occurrence of the disease, — already known in Europe more than a century ago, — in the United States, especially in New England. Fowl cholera, caused by *Bacillus bipolaris septicus*, has been controlled by inoculations with serum, which, however, have not given uniform results. The writer obtained good preventive results by means of subcutaneous injections with from two to four cc. of 5 per cent carbolic acid, repeated daily for a week.

In the second work, prepared with the collaboration of ELIZABETH E. AMISON ("A Biological Study of Eleven Pathogenic Organisms from Cholera-like Diseases in Poultry", *ibid.*, Bulletin No. 146) the writers set forth the results of a biological study of eleven pathogenic organisms obtained from cholera-like diseases in poultry. The real fowl cholera caused by *Bact. bipolaris septicus* is endemic in New England and probably in all the central part of the Western States of the Union. There are, however, other diseases resembling fowl cholera caused by bacteria of the para-colon, para-typhoid or influenza groups.

The writers studied ten cultures of *Bact. bipolaris septicus* obtained from localities very distant from each other, and they found that the bacteria were in all cases identical. The virulence of the cultures examined varied considerably: the minimum dose of 48 hours' broth culture fatal to a fowl varied from 10 cc. to a millionth of a cubic μ, and the minimum dose fatal to a rabbit from 10 cc. to one hundred millionth of a cubic μ. It was demontrated that less than 50 bacteria, and probably only 4, injected

into the muscles of the chest were sufficient to cause infection. One is led to believe that in infected animals an immediate paralysis of the functions of the phagocytes takes place, whence the terrible infectiousness under natural conditions. The bacterium resists four months' esiccation (the maximum limit is still undetermined) ; it is killed by heating to 63° C for 15 minutes ; and it has very little resistance to carbolic acid and to acids in general.

A very virulent culture finds resistance in a susceptible animal when the latter has been previously inoculated with a homologous non-virulent culture. In rabbits, an artificial resistance to 10 billion times the minimum fatal dose of a highly virulent culture has been produced by a single strong dose : 3 cc. of the homologous culture. Only homologous cultures produced such resistance in rabbits.

The third work is a continuation of the preceding ones and deals with the nature of the immunity in rabbits and the production of a corresponding active immunity in fowls.

The writer gives a historical resumé of the inherited resistance to infectious diseases, from which he concludes : that immunity to certain infectious diseases, together with other phenomena dependent upon humoral factors of the blood, is transmissible from immune mothers to their offspring ; that the immunity thus transmitted and acquired, is due in reality to the transmission of antibodies, is not inherited and transmitted by the male and is not present in the second generation ; that inherited resistance is of short duration, but that in some cases it can be transformed into active resistance by inoculating the young animals with a virulent culture.

The cultures used in this study were the same as those employed in earlier investigations; they can be placed in two groups: the immunizing group and the infecting group. There has been found no morphological or cultural means of differentiating between the organisms of these two groups of cultures; the biological test alone serves to distinguish them. For the present research an immunizing (avirulent) culture was used. From his experimental results the writer concludes :

Female rabbits immunized with an avirulent culture of fowl cholera bacterium are able to transmit to their offspring a high degree of resistance to virulent cultures. Some immune mothers are able to produce such immune offspring for at least more than two years after the date of immunization. Immunity is not transmitted by the immune male. The resistance in the offspring is not permanent, enduring for not more than forty days. This inherited passive resistance can be transformed into a durable, active resistance by inoculating the young animals, some time within the first forty days of life, with a virulent culture.

ANATOMY AND PHYSIOLOGY

1140 – **On Ovariotomy in Sows; with Observations on the Mammary Glands and the Internal Genital Organs** (1). — MACKENZIE, K. J. J.; MARSHALL, F. H. A., and HAMMOND, J. (School of Agriculture, Cambridge in *The Journal of Agricultural Science*, Vol. IV, pp. 410-420; Vol. V, pp. 418-423; and Vol. VI, Part 2, pp. 182-186. Cambridge, 1912, 1913 and 1914.

It is commonly found that the flesh of pigs killed " on heat " produces inferior bacon and pork, and the occurrence of animals in this condition in the slaughterhouses causes considerable losses to various bacon-curing firms. Of recent years, notwithstanding these losses to bacon manufacturers and pork butchers, the practice of spaying has been on the decline and in many pig-raising districts has largely disappeared, the reason being that pigs are now made ready for the butcher before they are nine months old and are consequently less affected while in the feeders' hands by the neglect of the operation than when the are killed at a more advanced age, so that breeders hesitate to expose them to the slight risk of the operation. Moreover, many feeders aver that they find some spayed sows which behave like unoperated animals and consequently that the risk and slight expense are futile.

The writers examined three cases in which spayed sows were said to have behaved as if unspayed and found that in all three cases the operation had been incompletely performed, part of an ovary having been left behind in the body cavity and causing the undesirable symptons in the bacon pig, which consist chiefly in a greatly increased vascularisation in the mammary region and consequent depreciation of a valuable part of the pig. It would therefore appear that the objection to spaying on the grounds of its ineffectiveness put forward by feeders is without foundation, cases of failure being rather due to imperfect operations.

When examining carcasses in order to discard those of pigs killed on heat, bacon curers have been in the habit of regarding the presence of black melanic pigment in the deeper layers of the mammary tissues of coloured sows as due to extravasated blood and therefore a sign that the animal had been killed when on heat and that its carcass could only be used to produce bacon of an inferior grade. The writers examined a very large number of pigmented and unpigmented carcasses of both sexes and in various conditions with regard to their sexual organs; they obtained no evidence that the presence of the pigment was in any way associated with the sexual condition of the animal, but found that the pigment occurs only in certain dark-coloured animals. The remedy for this defect is to breed from animals in which the pigment is absent.

1141 – **On Some Factors Controlling Fertility in Domestic Animals.** — HAMMOND, JOHN, in *The Journal of Agricultural Science*, Vol. VI, Part 3, pp. 263-277 + 2 plates. London, September 1914.

The fertility of domestic animals is a subject of ever increasing importance, for with the improvement of the breeds of live stock there has come in many cases lessened fertility and often sterility. Thus, in Great

(1) See No. 1198, *B. Ang.* 1912. (*Ed.*).

Britain the Royal Commission on horse breeding found that about 40 per cent of the mares selected for breeding failed to produce foals.

PEARL has recently shown that the variation in fecundity (eggs produced) in various breeds of the common fowl is not anatomical; that a fertile strain of fowls does not necessarily contain more oocytes in the ovary than an infertile strain. He concluded that the fecundity of fowls depends on a physiological factor causing the oocytes to develop and grow. In mammals it is known that many oocytes atrophy at some stage of their development, but this has not yet been described in the common fowl. HEAPE and MARSHALL, who investigated the fertility of sheep, came to the conclusion that several factors influenced the number of ova shed during the heat period: among others, service early in the breeding season and the practice of "flushing", which seem to favour the ripening of the oocytes and prevent atrophy of the follicles. Nevertheless, some facts could not be explained as a simple result of the number of follicles which ripened, for instance the fact that in-breeding reduces fecundity while out crossing increases it, as has been observed by HEAPE in sheep, by DARWIN in pigs, by RITZEMA-BOS in rats, and by VON GUAITA in mice.

Since ovulation occurs spontaneously in the pig and is not influenced by copulation, the diminution of fertility on in-breeding must be due to other causes than the number of follicles rupturing at the heat periods. HEAPE suggested that in sheep the decreased fertility when in-bred might be due to some sort of abortion. STEPHENSON attributed many cases of sterility to the male, owing to a want of vitality, varying in degree, in the spermatozoa, which prevents the ovum or foetus reaching maturity and thus causes abortion.

The writer has endeavoured to determine the factors controlling the number of young produced at birth by counting the number of *corpora lutea* and foetuses in pregnant animals at various stages of gestation. The animals observed were rabbits, pigs and a bitch. The writer divides the factors controlling fertility into two groups:

1. Factors controlling the number of ova shed (fecundity, of PEARL).

2. Factors controlling the number of embryos which develop to reach maturity.

1. *Factors controlling the number of ova shed.*

In all probability it is as regards this factor that species and factors vary in the matter of fertility. It seems to be a complicated physiological factor which can be modified to a certain extent by improving the nutrition of the ovary. PEARL observed that the greatest egg production in fowls is in the first year; in general, fertility increases with age up to a certain limit, after which it falls gradually. It is well known that the number of offspring produced by a young animal breeding for the first time is below normal. MINOT has observed this fact with guinea-pigs, P. G. BAILEY with rabbits, WALLACE with sows. The writer has observed in 18 young sows that the number of *corpora lutea* varied from 11 to 19 and averaged 14.3 ± 0.39, whilst in 9 old sows it ranged from 13 to 24 and averaged

19.77 ± 1.26. It appears therefore that the lower fertility of young sows is due to a smaller number of ova being shed.

2. *Factors controlling the number of embryos which develop to reach maturity.* — The writer counted the *corpora lutea* in the ovaries and the number of foetuses in the uterus of pregnant sows, rabbits and a bitch, and found that the average number of ova shed at a heat is larger than that of the foetuses. In sows the number of ova was twenty, while the average litter of pigs is about twelve. In American breeds it appears to be even less: in Duroc Jerseys 9, and in Poland-Chinas 7.5. In rabbits the average number of *corpora lutea* was found to vary from 8.4 to 11, and the corresponding number of foetuses from 6.4 to 8.1. Of some of the ova shed at the time of conception no trace can be found in the uterus; it is supposed they may be lost by wandering into the body cavity instead of being caught by the Fallopian tubes. This, however, could not occur in the Carnivora, where the fimbriated end of the Fallopian tube completely surrounds the ovary. In the bitch examined by the writer the number of foetuses and *corpora lutea* were the same, namely five.

There is also the possibility that some of the ova may have escaped fertilization; or rather that they have been atrophized at a very early stage of development of the embryo, so as to leave no trace of their implantation.

Other ova shed from the ovary, although developing to a certain extent, never come to maturity and atrophy in the uterus.

The writer has found in sows and rabbits, and other observers have found in cows, sheep, hamsters and ferrets, that the pregnant uterus often contains, besides the normally developed foetuses, a few smaller ones in different degrees of development and in various stages of degeneration. Of seven sows observed by the writer, four contained atrophic foetuses with an average of 2.1 for the seven sows. Of 38 rabbits, 11 contained atrophic foetuses.

In animals bearing many young at birth this atrophy of the fertilized ovum is not very important economically, since, as a rule, many more ova are shed than would furnish foetuses to occupy the teats of the mammary gland. In animals producing only one or two young at a birth (mares and cows), however, the matter becomes one of great importance, for in these animals cases of complete sterility are frequent.

The cause of atrophic foetuses is not bacterial, since normal and atrophied foetuses are often found side by side; besides, the writer in his search for bacteria in the atrophic foetuses and in their membranes obtained only negative results.

The nutrition of the pregnant mother cannot be the cause of atrophy, though in many cases it affects the size and vigour of the new-born. From measurements made by the writer it appears that on the whole the longer the foetal membranes in pigs the larger the foetus. No connection has been found to exist (in pigs and rabbits) between the weight of the foetus and its position in the uterus; consequently competitive nutrition has very little effect in determining the size of the foetus. Fraenkel has shown that eth nutrition of the foetus is more especially under the control of the *corpus luteum*.

From an examination of the works of several investigators, it seems possible that the atrophy is due to the low vitality of the foetus owing to constitutional loss of vigour of either parent at the time of mating, or to insufficient vitality in the spermatozoa, or to domestication (the writer observed that in wild rabbits atrophic foetuses are much rares than in domestic rabbits). It seems that the effect of domestication on these animals is to increase the number of ova shed and at the same time to diminish the proportion of those which develop.

The writer does not arrive at any definitive conclusion on the cause of the atrophy, and the several possibilities suggested are still under investigation.

1142 – **Research on the Transformation of Energy in the Domestic Fowl.** — GERHARTZ, HEINRICH, in *Landwirtschaftliche Jahrbücher*, Vol. 46, Part 5, pp. 797-814. Berlin, July 14, 1914.

The most important investigations hitherto made by VÖLTZ, LEHMANN, PARATSCHUCK, RICHET, REGNAULT-REISET and others, on the transformation of energy in the domestic fowl, as well as in birds in general, are now no longer sufficient, as they do not correspond to modern demands upon the technique of observation and do not give due weight to the biological activity of the animals. The writer, with the assistance of the Prussian Ministry of Agriculture, undertook several experiments on this subject. They were carried out with an improved system of Regnault-Reseit's apparatus, in which the bird was in a state of repose throughout almost all the experiments and could be observed without being disturbed. The writer experimented upon fasting birds and birds that had been fed. In the first case the bird was not given any food during the 13 hours which preceded its being put into the respiratory apparatus. In the second case the bird usually ate its ration during the preliminary experiment. The ration was calculated to keep the weight of the body constant. When the bird was not in the respiratory apparatus it was kept in a roomy cage.

The object of the first experiments was to observe the quantity of energy transformed in the fowl when it was in a state of absolute repose and consumed only so much matter as was necessary to keep up its physiological activity. This transformation of energy is called by the writer the " minimum " or " upkeep transformation ", and it amounted to 58.37 calories for the normal fasting fowl and 62.15 calories for the same bird that had been fed, per day and per unit of surface (1000 square centimetres). In the brooding hen of the same breed after feeding, the corresponding figure was 71.78 calories. On comparing these values with those of Zuntz for dogs (75.1) and for horses (94.8), it appears that fowls in a state of absolute repose have not a relatively high transfomation of energy, but a relatively low one. An abnormally high transformation in birds is thus quite out of the question.

The next experiments were aimed at ascertaining how, and to what extent, the organs of reproduction and their functions acted on the minimum transformation. With this object experiments were made during the moulting and the brooding periods. They showed that during the moulting

period the transformation was slightly increased, namely by 5.2 per cent while the brooding period did not cause any change.

In a third series of experiments the writer endeavoured to determine whether the laying period, exclusive of the amount of energy required for the formation of the egg, had a specific action on the transformation. With this aim experiments were made before and after the laying period. If there was a specific surplus of energy beyond that required for the formation of the egg, it ought to be noticeable in the period of transition. The experiments showed that the transformation of energy went on increasing even after the period of egg-laying, which can only be explained by admitting a specific effect of the period of laying on the transformation of energy. Eight days before laying the first egg, as another experiment showed, this effect was not yet noticeable.

A last series of experiments was devoted to determining the influence of the function of egg-laying on the transformation of energy in the hen. With this object several tests were made. Of these the first group led to the following results. The period of egg-laying caused an increase of 70.1 calories in the transformation of energy, or 78 per cent per unit of surface per day. Each day 43.9 calories, or 26.2 per unit of surface, were employed for the formation of the egg. Admitting that the period of egg-laying itself, without considering the outlay of energy directly caused by the formation and expulsion of the egg, increases the transformation of energy by about 35 per cent (experimental results of successive periods), there would always remain 78 per cent — 35 per cent = 43 per cent for the formation of the egg and egg-laying proper.

In the second group of experiments on the egg-laying period, the results differed somewhat, for instead of the 26.2 calories per day and per unit of surface, 24.8 calories were utilized in the formation of the egg.

The figures obtained in these investigations are interesting also from another point of view. If, as has been stated above, 26.2 calories are consumed for the formation of the egg, 10.8 correspond to the protein and 15.4 to the fat. The fixation of these two substances requires, however, different contributions of energy. Admitting, with KLEIN and VON DER HEIDE, that for the formation of 1 gram of protein 7.25 calories are required, and for 1 gram of fat 2.5 calories, the fixation of the protein would have required 13.8 calories and that of the fat 4.1, thus altogether 17.9 But the period of egg-laying caused an increase of 70.1 calories in the transformation of energy. There remains therefore a surplus of 70.1 — 17.9. = 52.2 calories. Taking the specific influence of the laying period at 24.5 calories (that is 35 per cent of 70.1), there remains a difference of energy of 52.2 — 24.5 = 27.7 calories, corresponding especially to the formation of the egg above the expense of energy required for the formation of flesh. The formation of the egg in the hen is thus accompanied by a considerable expenditure of energy.

1143 – **The Preparation of Ensilage.** — SAMARANI, FRANCO, in *Bollettino del Ministero di Agricoltura, Industria e Commercio*, Year 13, Nos. 8-12, pp. 87-103. Rome, August-December, 1913.

The results of the experiments carried out for many years by the writer for the purpose of discovering the best method of preparing ensilage in ordinary silos have shown that during the first few days after the grass has been put in, two typical and different fermentation processes take place at the expense of the sugar and of the cell-sap — an acetic fermentation and a lactic fermentation.

The first is an intracellular process, through which the sugars of the cell substance are transformed, as a result of the vital activities of the cell in a relatively warm place (silo) where there is an almost complete absence of oxygen, into alcohol and carbonic acid. Later, as a result of chemical or physiological, but certainly not bacterial, action the alcohol is transformed into acetic acid. The second process is an ordinary lactic acid fermentation, due to the action of bacilli and cocci such as are found in milk and milk products. Of the total free acid content of normal acid silage, on an average 70 per cent is acetic acid, up to 20 per cent lactic acid, and, roughly speaking, 10 per cent butyric acid.

The predominance of the acetic acid is chiefly due to the fact that the temperature of the silo rises to 40-60° C, which is particularly favourable to intracellular fermentation. If, however, the lactic fermentation has free sugar at its disposal, it can, owing to its power of acting directly upon the latter, produce more acid than the acetic fermentation, which can only transform sugar into acid indirectly. When in the acid ensilage sufficient lactic and acetic acids have been produced, which takes place ten days after the filling and pressing down of the silo, no further bacterial fermentation goes on. If sufficient acidity is not soon attained by the two fermentation processes, a putrefactive fermentation sets up, with formation of ammonia, butyric acid and other malodorous compounds. Unsuitable fermentation, from the experience of the writer, is best prevented by the addition to the silage of a dilute solution of milk sugar.

From these observations, the conclusion can be drawn that in order to succeed in making ensilage, it is above all necessary to avoid overheating the fodder, in order to limit the acetic fermentation and thus to leave the decomposition of the sugar chiefly to the lactic fermentation process. This end can best be attained by providing the silo with mechanical means of applying pressure. The experiments of the writer in this direction showed that mechanical pressure is best applied immediately after the required amount of fodder has been put in, so as by this means to free the silo as much as possible from air. When the interior of the silo is once free of air, the temperature rises with difficulty and the lactic fermentation is promoted at the expense of the acetic fermentation.

According to observations made by the writer, silos with mechanical presses yield a fodder with 70 per cent lactic acid and 20 per cent acetic acid, while the proportion is just reversed in the product of an ordinary silo. Further, they have the additional advantage of producing ensilage containing less free acid and which consequently smells less strongly.

In conclusion, the writer gives some information respecting an ensilage experiment with beet slices straight from the sugar factory. He found that in order to obtain a satisfactory product, it was necessary to remove all the air from the silo. This was of course best effected by heavy pressure.

In order to promote lactic fermentation, Sig. Samarani advises, as in the treatment of grass, the addition to the silage of a solution of milk sugar.

1144 – **The Forage Value of Redshank *(Polygonum lapathifolium)*.** — STÖRME and KLEIN, in *Deutsche Landwirtschaftliche Presse*, Year 41, No. 80, p. 890. Berlin, October 7, 1914.

Redshank (*Polygonum lapathifolium*) was used by many farmers as fodder in Germany during 1914. Its chemical composition is, according to a recent analysis made at the Köslin Experiment Station, as follows :

Water		71.74 per cent.
Dry matter :		
Ash	2.29 per cent.	
Crude fat	0.69 »	
Crude protein	3.07 »	
Crude fibre	8.08 »	
Nitrogen-free extract	14.03 »	
		28.16 »
		99.90 per cent.

The digestible substances are :

Crude protein	1.72 per cent.
Pure protein	1.25 »
Fat	0.35 »
Crude fibre	4.70 »
Carbohydrates	9.35 »
	17.37 per cent.

According to the above analysis, the food value of redshank is equal to that of pasture grasses such as rye-grass and cocksfoot.

All practical farmers agree in stating that redshank has given complete satisfaction as fodder and that it has not caused the slightest injury to the health of the animals. As food for milch-cows it has also been useful. The writer believes that in years of scarcity of forage it will prove a welcome addition to the food supply.

1145 – **The Influence of Temperature on the Microflora of Hay : Lactic and Butyric Hays.** — GORINI, C., in *Rendiconti della R. Accademia dei Lincei*, Vol. XXIII, Series V, Part 1, No. 12. Rome, 1914.

Applying the methods of silo research (1) to hay, it has been possible to determine a main difference between normal and abnormal hay. Those hays are to be called normal which have not undergone abnormal maceration or fermentation, nor become mouldy, scorched or damaged. Normal hays are divided into normal lactic and butyric hays according to the nature of the predominating fermentation.

(1) See No. 541, *B.* June 1914. (*Ed.*).

The writer submitted the same hay stack during its various stages of fermentation to zymoscopic and bacteriological examination. He found that during the first 3 to 5 days of fermentation, with a temperature of 50-55° C., the hay was prevailingly lactic, whilst as the temperature gradually rose to 60-65° C. and beyond, the mass tended to become more butyric, as is unfortunately often the case in ordinary stacks.

The results confirm those obtained in the case of silos :

1) Normal hay may be classified as lactic or butyric according to the predominating microflora.

2) The nature of the microflora is in direct relation to the temperature of fermentation.

3) Most hay, as in the case of ordinary silage, is of the butyric type and is consequently less favourable to the intestinal functions of the live stock and to the sanitary condition of the milk and its products.

4) To obtain lactic hay, care should be taken in stacking it to expel as much air as possible and to maintain a temperature of about 50° C.

These conclusions show the importance of zymoscopic-bacteriological control of fodder in order to estimate its value as forage from a health and dairy point of view. Thus a normal hay may as a result of organcleptic, chemical or simple microscopic examination be declared healthy and yet contain a microflora dangerous to the intestinal functions and health of stock and consequently to the quality of the milk and dairy products.

1146 – **The Food Value of *Stizolobium aterrimum* and *S. pachylobium* Beans.** — SHREWSBURY, HERBERT S., in *Bulletin of the Department of Agriculture, Trinidad and Tobago*, Vol. XIII, No. 81, pp. 194-195; and No. 82, pp. 240-241. Port-of-Spain, June and July, 1914.

The seeds of the two species of *Stizolobium* grown on the same estate in Trinidad, in the same seasons, were recently submitted to the Department with a request for information as to their suitability for fodder.

Their nutritive value is shown by the accompanying table; it is very nearly the same for both species, but *S. pachylobium* is somewhat preferable because it has larger seeds and consequently a lesser proportion of teguments and indigestible crude fibre.

Feeding experiments on guinea-pigs showed it to be highly improbable that the beans were toxic in the slightest degree.

On analysis no poisonous glucosides, saponins, fats, alkaloids, vegetable ptomaines or toxalbumins were found. Besides, the beans of *S. pachylobium* have been used as fodder and also for human food without ill effets. It does not appear, however, that *S. aterrimum* has ever been used, in Barbados, as fodder or as human food, while the leaves are said to have poisoned cattle. It is not yet quite certain that *S. aterrimum* is not a synonym for *S. utile* or *Mucuna utilis* of Wallich, which has been cultivated extensively in Mauritius and Tasmania as a table vegetable and as a fodder for cattle.

In the accompanying table the composition of soy beans is also given for comparison. The two *Stizolobium* are inferior in feeding value

to soy beans, but they are somewhat superior to French, Lima or field beans.

	Carbo-hydrates	Proteins	Water	Crude fibre	Ash	Fat	Feeding units
S. aterrimum	44.3	29.8	12.0	6.2	4.2	3.5	127
S. pachylobium . . .	47.2	29.2	11.0	4.1	4.2	4.3	131
Soja hispida	39.2	33.2	10.0	4.4	4.7	17.5	157

1147 – **Statistics of British Feeding Trials and the Starch Equivalent Theory.** — Wood, T. B., and Yule, Udny G. (School of Agriculture, Cambridge) in *The Journal of Agricultural Science*, Vol. VI. Part 2, pp. 233-251. Cambridge, May 1914.

Summaries of about 400 feeding trials (200 dealing with oxen and 200 with sheep) were compiled from reports of British experiments carried out down to 1907 and were published in the Journal of the Highland and Agricultural Society for 1909-1910. The present paper makes a statistical examination of these summaries for the purpose of investigating the reason why British experimenters, calculating on the basis of Kellner's figures, usually find that the increases produced by various diets are not proportional to the excess of starch equivalent provided by the diets above that required for maintenance.

Swedes were the first to be investigated in this connection, as they represent an article of food used to a much larger extent in Great Britain than on the continent, and it seemed quite possible that Kellner's figures for starch equivalents in roots, which are based on a small number of experiments, are not accurate when roots are used in such large amounts as is usual in British farming. All experiments dealing with the feeding of swedes to oxen were abstracted from the summaries, and, after deducting the food required for maintenance from the other constituents of the diets as far as possible, the results of feeding swedes were obtained in terms of increase as follows :

Corrected weight of swedes in ration above maintenance, per 1000 lbs. live weight per day	Number of experiments	Average live weight increase produced per 1000 lbs. live weight per day	Probable error of average
lbs.		lbs.	
40 to 60	3	1.46	—
60 » 80	4	1.73	—
80 » 100	14	1.72	0.082
100 » 120	17	1.83	0.061
120 » 140	13	1.93	0.078
140 » 160	8	1.85	0.048
over 160	3	2.39	—

Now assuming that the increase consists of 67 per cent. of fat and 33 per cent. of water (LAWES and GILBERT) and that 1 gm. of starch equivalent yields 3.76 calories in the animal and 1 gm. of fat 8.8 calories, the following rough approximation to the percentage utilisation is obtained for swedes used in varying quantities above maintenance:

Corrected weight of swedes in ration above maintenance, per 1000 lbs. live weight per day	Percentage utilisation
lbs.	—
50	51
70	43
90	33
110	29
130	26
150	21

The figures receive some support from the fact that Kellner's average figure for percentage utilization is 50 per cent. which is about the same as the utilisation of swedes in the British trials when used in small quantities. They also agree with figures directly determined in the winter of 1913-1914, when two lots of 10 oxen of similar weights were fed on just sufficient cake and chaff to supply maintenance, the one lot receiving in addition 46 lbs. of swedes, the other 138 lbs. In the former case the percentage utilization was 47; in the latter it fell to 32. In the experiments on which Kellner based his starch equivalents, the amounts of food added to the basal ration varied very considerably, yet there is always direct proportionality over a wide range of diet between the excess of food above that required for maintenance and the amount of increase produced, and in all cases approximately 50 per cent. of the excess of food expressed as calories above maintenance requirements was utilized as increase in live weight.

The next step was to recalculate the results of all the experiments given in the above-mentioned summaries in order to determine their percentage utilization. The new results were as follows:

Lbs. starch equivalent above maintenance: oxen per day sheep per week	Percentage utilisation	
	Oxen	Sheep
3 – 4	—	58 ± 5
4 – 5	—	48 ± 5
5 – 6	—	56 ± 3
6 – 7	39 ± 2	48 ± 2
7 – 8	35 ± 2	46 ± 2
8 – 9	34 ± 1	37 ± 2
9 – 10	32 ± 1	37 ± 2
10 – 11	30 ± 2	42 ± 2
11 – 12	26 ± 2	—
12 – 13	24 ± 1	—
13 – 14	21 ± 1	—

These figures agree with those given above for the utilization of swedes: the larger the amount of food above the maintenance ration, the smaller the proportion utilized, yet the figures are comparable with Kellner's at any rate as regards range of diet. The difference between the two sets of results make it clear why British experimenters do not obtain results in their feeding trials which agree with Kellner's starch equivalent theory: Kellner's starch equivalents are based on figures which indicate a direct proportionality between the amount of food consumed above the maintenance ration and the live weight increase produced, while British feeding trials indicate clearly and with certainty that the percentage utilization of food decreases as the diet is increased, each successive increase giving a smaller return in live weight increase than the last.

As a possible explanation of the divergence between Kellner's and British experience, the probable errors of the results were worked out and removed all doubt as to the significance of the differences observed. Another possibility was that whilst Kellner's figures are based on experiments in a respiration chamber, in which the carbon fixed in the form of increased weight was accurately determined by means of a carbon balance, the British results were obtained in ordinary feeding trials in which the utilization is calculated from the increase in live weight by a factor depending on a very small number of experiments carried out at Rothamsted many years ago. This factor may be assumed to give the proportion of fat in the total increase of weight as a lean animal becomes fat, but it may fail to give with accuracy the proportion of fat in successive increases as the animal slowly fattens from the lean condition. There is some evidence to show that the first addition of live weight increase to a lean animal may contain as much as 50 per cent. of water and only 50 per cent. of fat, whilst the last additions of weight to the animals may be almost entirely fat. In the case of the oxen this would increase the lowest utilization with the highest diet from 21 per cent. to 31.5 per cent., which is still significantly below the highest percentage utilization of 39 per cent. and much lower than Kellner's average figure of 50 per cent.

A further reason for divergence might lie in the fact that whilst Kellner's experiments were confined to the measurement of the carbon balance for a short period including the formation of only a few pounds of fat, the period of the British experiments was some four on five months, during which the animals laid on several hundredweights of live weight increase; it is quite possible that there might be a direct proportionality between food and increase in the early stages of fattening whilst the animal is still comparatively lean. Accordingly all the experiments with oxen were classified according to the period of feeding and their percentage utilization was worked out as follows:

Length of experiments in days	Percentage utilization
20 to 80	32
80 » 100	31
100 » 120	33
120 » 180	32

Evidently the length of time of the experiment has on the average no effect on the percentage utilization of food, the reason of this probably being that in some of the shorter experiments animals already half fat were used, and under these circumstances, the length of the experiment is not a measure of the extent to which the fattening process was pushed. The question was therefore attacked by calculating the percentage utilization during the various stages of fattening in a separate series of trials, the detailed data of which were available. The results are given below.

	Percentage utilization
1st month	39
2nd »	34
3rd »	31
4th »	15

The average utilization is very good during the first month and does not fall off much during the second and third months, but in the fourth month the falling-off is very striking indeed. It would therefore appear that whilst Kellner's starch equivalents may give a fairly accurate measure of the amount of fat production to be expected from various foods in the early stages of fattening, they fail to do so in the later stages, because as fattening approaches completion, the law of diminishing returns asserts itself and a given amount of starch equivalent produces less and less fat as time goes on and the animal gets ripe. Kellner's starch equivalents, too, fail when very liberal diets are used, because here the animal very quickly reaches that stage of fatness at which the law of diminishing returns begins to make itself felt.

The writers point out the remarkable variation in efficiency, as fat-producing machines, among animals of the same breed fed under identical conditions and show that the standard deviation under these conditions is 21 per cent. of the live weight increase and the probable error in the increase of one animal 14 per cent. Calculating on this basis, average-sized animals on average rations having a heat value of 25 400 calories would retain from 6 400 cals. to 8 400 cals. in their bodies and give out heat amounting to 19 000 and 17 000 cals. respectively. Examination of the increase of individual oxen shows that, assuming that similar amounts of food are digested, the differences between the amounts of heat evolved are even larger than those indicated above and may reach 25 per cent. between what the farmer would call a good and bad "doer". Investigations are at present in progress at Cambridge on the variation of digestibility according to the individual peculiarities of the animal and the amount of diet, and on the possibility of estimating the rate of heat evolution from animals of known fattening capacity by measuring the difference between their skin temperatures and the temperature of the surrounding air.

1148 – **Feeding Experiments with Whole Milk and Skimmed Milk with Cream Substitutes** (1). — WELLMANN. — Reprint from *Landwitschaftlichen Jahrbücher*, pp. 499-626. Berlin, 1914.

The writer made comparative experiments on the utilization of whole milk and of skimmed milk with cream substitutes for feeding calves and young pigs.

The fresh whole milk of the day was pasteurized for a quarter of an hour, then cooled and kept in a cool place in well closed cans.

The additions to the skimmed milk consisted of meal and of flour starch saccharified by diafarine (a preparation of diastase); it was also homogenized with a preparation of tallow known in trade under the name of " Premier jus ".

The skimmed milk with meal was prepared as follows: the daily fresh skimmed milk was passed through a sieve and pasteurized; while still warm it received the addition of 54 parts of wheat meal, 27 of rye meal and 1 of common salt per 1000 parts by weight of liquid. The mixture was passed a second time through a fine sieve and then kept in a well closed vessel.

The diafarine skimmed milk was prepared in the following manner: After being passed through a sieve and pasteurized it was cooled to 55-60° C. and mixed with 50 parts by weight of wheat meal, 25 parts of rye meal and 7.5 of diafarine per 1000 parts of liquid.

In another experiment skimmed and whole milk were mixed and to this mixture (containing 2.5 per cent of fat), 50 parts of wheat meal and 25 of rye meal per 1000 were added, together with 7.5 parts of diafarine with the object of saccharifying the meal starch. This preparation is called by the writer " Diafarin-Fettmilch ".

The homogenized milk was prepared by mixing the tallow preparation intimately with skimmed milk.

Eleven pigs from two to four weeks old were experimented upon; two of these were slaughtered at the beginning of the experiment as controls, the others at the end. The milk was always given *ad lib.*

The experiment showed that from a dietetic point of view whole milk, diafarine milk, and skimmed milk with meal gave the best results; no intestinal troubles occurred with the use of these feeds. The animals seemed to relish most of all the diafarine milk. The homogenized milk was always willingly taken, but one animal fed on it had an attack of scour which was soon arrested by some citric acid.

The digestibility of the various milks was, on the whole, the same, even when that of the individual foods was different. The high digestibility of the fat in the homogenized milk was striking; although there was 6 per cent of fat it was utilized even better than in the whole milk. Protein proved more digestible in the milk with wider albuminoid ratio (homo-

(1) See also the original articles: 1) Prof. PAUL SCHUPPLI, Calf Rearing on the Emulsion System, *B.* Feb. 1913, pp. 167-173; and 2.) Prof. ANTONIO PIROCCHI, Utilization of Skimmed Milk as Food for Calves, *B.* Aug. 1913, pp. 1157-1164. (*Ed.*).

genized milk) than in that with a narrower ratio (whole milk, diafarine-skimmed milk). In most cases the young pigs utilized the milk better as they grew older.

The greatest assimilation of nutritive matter per 1000 of live-weight was observed with diafarine-skimmed milk (35.93), and " diafarin-fett milch " (38.5), and meal and skimmed milk (45.53). With whole milk the corresponding figure was only 30, and with homogenized milk 30.47. In the consumption of starch values the difference between the four kinds of milk was barely 15 or 20 per cent.

The daily increase per 100 lbs. of live-weight ranged from 2.2 to 3.5 lbs., and diminished with increasing age. It varied from 3.08 to 3.34 lbs. for whole and homogenized milk; it was 3.25 lbs. for diafarine-skimmed milk and 3.5 lbs. for " diafarin-fett milch ". The pigs retained in their bodies from 36 to 74 per cent. of the digestible nitrogen supplied.

From an economical point of view, diafarine skimmed milk was the most satisfactory and " diafarin-fett milch " the least.

The cost of one pound of gain varied with the different feeds as follows :

	d
Whole milk	7.11
Diafarine-skimmed milk	3.10
Meal-skimmed milk	3.53
Diafarin-fett milch	7.80
Homogenized milk	4.65

Thus, feeding with diafarine-skimmed milk costs about one-half, and with homogenized milk about two-thirds of the expense of feeding whole milk.

In the pigs fed on diafarin the flesh was singularly light coloured.

The paper contains data on the weights of the different organs of the pigs and on the analysis of the flesh.

HORSES ASSES AND MULES

1149 – **The Breeds of Horses of the Sunda Archipelago.** — Von Barnekow, Hans, in *Zeitschrift für Gestütkunde und Pferdezucht*, Year 9, Part 9, pp. 194-198. Hanover, September 1914.

This paper is a brief review of the most important breeds of horses of the Sunda Archipelago, namely : Sandalwood, Macassar, Sumbawa, Savonese, Timor, Batak, Boverlander, Java and Preanger.

The *Sandalwood* horse is a native of Soemba island and is considered on the whole as the best of the archipelago. For scores of years it has been exported in numbers to Java ; consequently the stock has diminished to such an extent that measures had to be taken for the preservation of the breed. Its body is compact and is supported by sound and strong feet, so that the horse is especially suited for the saddle. The strong strain of Arab blood with which it has been credited can no longer be recognized in it owing to long-continued inbreeding. The Sandalwood has a very regular pace and is an excellent trotter. It combines a lively fiery temperament with great good nature. Its coat varies, but jet black, dark brown and piebald are the commonest.

The *Macassar* breed found in Celebes is the one that approaches most the Sandalwood. It is smaller and not so handsome, but its frame is stronger, it is more resistant and thriftier and it is much appreciated as a cavalry horse. It is bred by the natives, who are distinguished above all the other Malays for their skill in breeding. Nevertheless this breed is threatened, more than any other breed, with extinction, as hitherto neither the Government nor the leading breeders have been able to control the destructive disease known locally as "Niewe Ziekte".

The third breed of the Sunda Archipelago is that of the *Sumbawa* horses, from the island of the same name. They are decidedly draught horses and possess powerful limbs with clean bones and sound hoofs. They are smaller than the preceding breeds and combine a good nature with extraordinary resistance, which renders them very suitable for artillery. At present Sumbawas are the most numerous breed in the islands. Their exportation ranges between 8000 and 10 000 head per annum. The dreaded Tambora disease, a consequence of shortage of forage and of drought, has never sensibly diminished the stock of Sumbawa horses.

The next breed allied to the Sumbawas is the *Bimanese*; it is a native of the same island and is chiefly used for the pack saddle.

A special breed is the *Savonese* from the island Savoe. The horses of this breed are not very numerous; they are the result of a cross with the Sandalwood and, like the allied Rottinese breed, are fast carriage horses; they are much esteemed and exported to Java and Celebes.

The *Timor* breed, from the island of Timor, is really a diminutive Sandalwood. It was once held in great repute, but continuous inbreeding has so deteriorated it that its exportation has greatly diminished. Endeavours are now being made to restore this excellent breed to its original high level.

A horse that outwardly much resembles the Sandalwood is the *Batak*, which for its usefulness is superior to all the other breeds. Its real home is the high plateau of Sumatra, and especially the shores of the great Toba lake. Its conformation is handsomer than that of any other breed and renders it as suitable for the saddle as for draught. Batak horses are in great demand on the tobacco plantations of British India, Singapore, Malacca and Penang.

The collective name of *Bovenland* horses is given to all the other breeds of the west coast of Sumatra. They differ a good deal in build and usefulness from each other; they are heavier than the preceding breed, and do not equal them in general utility. Many fine and strong stallions are to be found among them, but unfortunately they are not used for breeding purposes but as saddle horses.

The *Java* horse is an insignificant, weak animal, suitable only for light draught. It is bred chiefly in the mountains; the best animals, however, are found in the rich grazing districts of the south coast.

The last breed of the Sunda archipelago which deserves mention is the *Preanger*, which owes its origin to the crosses of Persian, Arabian, and east European stallions with Java mares. Later Australian, Cape

Sandalwood, and Macassar blood was introduced for its improvement. From this mixture of various bloods a breed has been formed which is equally suitable for riding and for driving, Unfortunately it is bred only in the island of Preanger, and thus it is mostly known to the white population only by name. Its exterior conformation is especially harmonious.

1150 – **Holstein Milk Yield.** — MARSHALL, F. R. (Bureau of Animal Industry, U. S. Department of Agriculture) in *The Journal of Heredity*, Vol. V, No. 10, pp. 436-439. Washington, D. C., October 1914. CATTLE

The study reported in this paper relates to inheritance, through paternal and maternal lines, of factors controlling the production of butter-fat. It consists in the examination of records of cows as reported in the Blue Book compiled annually from the Advanced Register for the Holstein Breed. Here only selected material is dealt with, as only the good yields are registered. These were all seven-day records made at various ages and giving the pounds of milk yielded, pounds of fat and per cent of fat.

In Vol. 10 of the above Register, there were found 1317 cases of cows having official records and whose paternal grandams also had records. In addition, there were 678 cases in which a record-making individual had a maternal grandam with a record.

The difficulty of variation in age was overcome by arranging the "paternal grandam" and "maternal grandam" cards in two parallel sets. Having a much larger number in the paternal set it was possible to select therefrom, for each maternal card, one in which the age of the cow and of the grandam corresponded very closely. This arrangement left 665 cards in each group.

The coefficient of correlation for each group in respect to total milk, total fat and per cent of fat, is shown in the accompanying table (1).

Taking the opposing pairs of cards in order to see in which there was the greatest similarity between the records of grand-daughter and grandam the following results were obtained:

	Number of cases in which resemblauce was closest	
	on maternal side	on paternal side
Pounds of milk	403	262
Pounds of butter-fat	407	258
Per cent. of butter-fat	345	320

(1) DAVENPORT'S statistical method is adopted.
M. represents the average of the readings.
Em, the probable mean error.
σ, the standard deviation.
E σ, the relative probable error.
r or $\sqrt{\ }$, the correlation coefficient.
Er, the relative probable error.

(*Ed.*).

	M	Em	σ	E σ	r	Er
Pounds of milk.						
Through Sires.						
Grand-daughters	370.6	± 2.29	88.5	± 1.67	— 0.05	± 0.025
Grandams	475.3	± 2.56	98.7	± 1.95	— 0.05	± 0.025
Through Dams.						
Grand-danghters	393.4	± 2.63	99.5	± 1.95	— 0.012	± 0.02
Grandams	437.4	± 2.09	80.8	± 1.54	—	—
Pounds of butter-fat.						
Through Sires.						
Grand-daughters	12.68	± 0.089	3.41	± 0.062	— 0.04	± 0.025
Grandams	16.93	± 0.108	4.14	± 0.076	—	—
Through Dams.						
Grand-daughters	14.00	± 0.101	3.97	± 0.07	0.06	± 0.026
Grandams	15.83	± 0.087	3.31	± 0.06	—	—
Percentage of butter-fat.						
Through Sires.						
Grand-daughters	3.47	± 0.009	± 0.432	± 0.008	0.107	± 0.02
Grandams	3.57	± 0.011	± 0.448	± 0.008	—	—
Through Dams.						
Grand-daughters	3.55	± 0.011	± 0.445	± 0.008	0.213	± 0.02
Grandams	3.50	± 0.013	± 0.488	± 0.009	—	—

In the two sets of cases already discussed there was a smaller number of paternal than of maternal grandams, due to the fact that cows have many more grand-daughters through their sons than through their daughters. This objection and the further objection as to environmental influence upon total production is removed in a further study relating entirely to per cent. of butter fat.

In the second part of the study of this case there were taken 126 record cows having record grand-daughters through both sons and daughters. The number of grand-daughters is 340 through paternal descent and 340 through maternal descent from 126 common grandams. Each grandam was represented by not less than one nor more than six grand-daughters in either line. Here also the ages of granddaughters and grandams in one line correspond closely with those in the other line. The means, standards of deviation and coefficients of correlation in this case of common grandams were as follows :

	M % fat	E	σ	E	
Paternal Descent.					
Grand-daughters	3.52	± 0.02	0.442	± 0.01	$\sqrt{\ } = 0.157$
Grandams	3.51	± 0.02	0.406	± 0.01	E ± 0.028
Maternal Descent.					
Grand-daughters	3.60	± 0.02	0.489	± 0.01	$\sqrt{\ } = 0.155$
Grandams	3.51	± 0.02	0.406	± 0.01	E ± 0.028

The difference between 0.155 and 0.157 does not indicate any difference between transmission of the character of percentage of butter-fat in milk through males and females. The impression to the contrary held by some cattle breeders is not borne out by this investigation.

1151 – **Economical Cattle Feeding in the Corn Belt.** — COTTON, J. S. (Agriculturist, Bureau of Plant Industry) and WARD, W. F. (Senior Animal Husbandman in Beef Cattle Investigations, Bureau of Animal Industry) in *U. S. Department of Agriculture, Farmer's Bulletin*, No. 588, 19 pp. + 6 figs. Washington, 1914.

The cattle-feeding business in the corn belt of the United States has changed greatly during recent years. Formerly steers from 4 to 6 years were fed in large numbers upon commercial foods at yards near granaries or mills, or on large farms where only the roughage was grown and the cattle were kept on full feed for six months or longer. This method, however, became too expensive, so the cattle are now usually fed in small herds up to the age of 18 to 36 months, utilizing the products of the farms.

The cattle were either grown in the corn belt itself or came from the western ranges. The native cattle were usually grown on the rougher farms or on small farms where dual purpose cows were kept. They were usually sold to local feeders as yearlings or two-year-olds. Some feeders desiring animals of extra good quality raised their own feeders. The rapid advance in the prices of land and farm products made it unprofitable to compete with the western ranges in the production of stocker and feeder cattle. Therefore the breeding herds were greatly reduced or were changed to dairy cows.

On the other hand, the spread of dry farming has resulted in the best lands of the open range being taken up for grain-growing purposes, and the excessive liquidation of cattle has resulted in a shortage of feeder cattle and raised their price, so that securing feeders is a serious problem which must be solved by many farmers raising their own cattle. On the high-priced lands capable of intensive cultivation it is questionable if this can be done economically, but there are numerous farms within this region where a considerable proportion of the land is too rough for economical tillage and on which, with prevailing prices, stock cattle can be raised advantageously.

Cost of producing cattle. — The cost of raising a calf six months old weighing 450 pounds varies from $17 to $23 in the West and from $20 to $28 in the East. In a ranch in Kansas, where land is worth $50 an acre the cows being valued $70 each and assuming that 85 per cent of them drop a calf every year, the cost of a calf is $22.93 and at the age of 2½ years about $55. This figure is about the maximum cost of such a steer in the maize belt, and many of the western ranches raise similar steers for less money. It has been observed that the cost of the calf will be a little less if it is weaned and the milk sold, than if it is allowed to run with its mother.

While in 1899, 883 857 calves, having an average value of $8.20, were slaughtered in the wholesale slaughtering houses, in 1909, 2 504 728 calves with an average value of $10 were slaughtered, an increase of 183 per cent. in 10 years, whereas the corresponding increase in cattle for the same period was but 47 per cent. This growing demand for veal has raised its price, until a calf will sell from $8 to $12 when only 2 or 3 months old, so that it is usually more profitable to sell them to the butcher than to raise them.

In order to determine as accurately as possible the cost of feeding, cost-accounting records were kept for two years on 24 Iowa farms. During the year beginning with the autumn of 1909 the average profit on 961 cattle fed in 22 bunches was $2.05 per head in addition to the profits on the 1504 hogs following these steers, and which received extra grain besides. Market prices in the spring of 1910 were such that a profit of $6.67 per hog was secured. The following year 1910-11 proved unsatisfactory, due to prices which caused a loss of 78 cents per head on 1138 cattle that were fed on 28 farms. The 1646 hogs following these steers returned an average profit of $3.33.

The following table shows the proportionate cost of different items based on the cost-accounting records of the 24 Iowa farms.

Percentage of the various expenses incurred in cattle feeding.

Year	Purchase price	Feed	Interest at 6 per cent	Labour	Shipping and selling	Total
1909–10	55.8	36.9	1.3	1.6	4.4	100
1910–11	59.9	31.8	1.8	1.8	4.7	100

In this table no account is kept of interest, taxes, and depreciation charges on the feeding plant, as these and other incidental charges are about offset by the value of the manure.

According to experiments made at the Missouri Experiment Station, it appears that a bushel of maize will produce 6.9 pounds of gain when the cattle are fed on pasture in summer, as against 5.6 pounds in winter feeding. Therefore in general summer feeding is considered more profitable. On

the other hand winter feeding allows of the better use of the by-products and of the better distribution of labour.

Formerly 6 to 8 months were required for making prime beef. Now cattle are rarely kept on full feed for more than five months.

The construction of a silo (over ground, on a circular base) is not economical unless at least 100 tons of silage are consumed. Besides, in years of cheap alfalfa or clover, when hay is worth less than $8 per ton, it is doubtful if silage costing $3 a ton will prove economical. However, when hay is dearer silage will be profitable.

Considering the limited margin of profit on breeding beef it is prudent to combine it with hogs following the fattening cattle, for the former utilize a greater quantity of the by-products. The best type of hog to run behind cattle is a shoat weighing about 100 pounds; heavy nearly finished hogs are not profitable behind steers and should be placed by themselves.

It is usually best to allow one shoat per steer when shelled maize is fed and two when ear corn is used. When the maize is ground or soaked, or silage is used, the number of hogs would be less. The aim should be to run enough hogs to clean up all the waste maize.

The daily gain of the hogs varies with the conditions of the feed yard and the quantity and form of the grain given. In general one may reckon on three-fourths of a pound of pork per third of a bushel of shelled maize fed per steer. When ear maize is fed the gains will be greater and when maize, or maize and cob meal is fed, less.

The gain will be greater if the steers are fed some leguminous hay or some concentrate high in protein, such as oil cake.

Nearly all farmers give the hogs some extra maize, which is fed away from the steers.

The shrinkage in weight in shipping cattle from Iowa to Chicago or from points in Kansas to Kansas City would be from 3 ½ to 5 per cent of their live-weight, with an average of 4 per cent.

1152 – **Origin of Karakul Sheep** (1). — YOUNG, C. C., in *The Journal of Heredity*, Vol. V, No. 10, pp. 445-447. Washington, October 1914. SHEEP

Some 26 years ago Dr. Sinitzin described the various breeds of sheep in Bokhara that produce valuable lamb skins. He distinguished; 1) the small Arabi, 2) the large Arabi, 3) the Duzbai, 4) the Shiraz, and 5) the Zigai breeds. He considers the small Arabi as the origin of all the fur-bearing sheep of Central Asia, including the Malitch of Crimea, the Tshushka of Bessarabia and the Reshetilev and Sokoliev of Poltova province.

According to this theory the small Arabi is descended from the Mamai, the oldest breed of domesticated sheep. But as the Mamai is a fat-rumped sheep (*Ovis steatopyga*) while all the Karakul breeds are broad-tails (*Ovis platyura*), the author does not endorse Dr. Sinitzin's classification; his own experience has shown him that when a long-tail sheep is crossed with a fat-rump the result is a broad-tail, and while the first cross looks more like a typical Russian fat-tail (Jirnochvostaja), the second and third crosses

(1) See also No. 929, *B.* Oct. 1914. (*Ed.*).

cannot be classified otherwise than as broad-tails. He therefore concludes that the Karakul breeds resulted from crosses of long-tail sheep on fat-rumps.

In all the cases observed by the writer the black pigment in the wool of the mature sheep did not oxidize into gray as is the case with the Arabi and also with the Duzbai, for which reason he concludes that the small Arabi was a hybrid and a not very well fixed one, and that some black long-tail sheep together with a fat-rump entered into the formation of the breed.

The presence of fat-rump blood is easily traceable in the Duzbai, which has the long drooping ears that characterize *Ovis steatopyga*, the Roman nose, large head, very thick feet, enormous weight and a tail with fat accumulation; besides, the Duzbai lambs frequently come fawn, which is the natural colour of the fat-rump.

According to information collected by the writer at New Bokhara, 60 years ago there were neither Arabi nor Duzbai sheep in Bokhara; the only fur-bearing breed which produced beautiful fur was the black long-tail Danadar. In the spring of this year 1914 the writer was able to see the only flock of gray Danadar sheep which still exists in the Khanate of Bokhara, at about 100 miles from Old Bokhara, the capital of the Khanate. The owner of the flock said that after the conquest of Bokhara by Russia in 1865 the demand for Danadar lambskins increased and the natives began to cross their black sheep with white fine-wool Afghans. This in time produced the gray Danadar breed, the lambs of which produce skins with small curls rather open and lustreless. This introduction of white blood contaminated with fat-rump blood in time changed the black Danadar into the small Arabi. The cross of the black Danadar on the fat-rumps produced the Duzbai. The gray Shiraz evolved from the gray Danadar with a fat-rump admixture. The Zigai is a typical Russian breed that never existed in Central Asia, and if there are any they must have been taken there by Russian Tartars who settled in Turkestan. Sinitzin's large Arabi is the same animal as the Duzbai.

There can be no doubt that the Tshushka and Sokoliev — both long-tails — are also descended from the black Danadars. The Luk-Nakbo of Tibet and the black Gadik of Afghanistan, some few of which are still found between Mazar-i-Sherif and Cabul, are closely related to the black Danadar.

The writer has started an experimental farm in Bessarabia for the breeding of Karakul sheep; hitherto he has succeeded in securing Karakul sheep from the districts of Karshi, Kerki, Gissar, Tjarjui, Burdalik and Karakul. In Bokhara the Karakul breeds are hastening towards extinction owing to the killing of all the good lambs and to the continuous infusion of fine-wool Afghan blood.

PIGS 1153 – **Pasture and Grain Crops for Hogs in the Pacific Northwest.** — HUNTER, BYRON (Agriculturist, Office of Farm Management) in *U. S. Department of Agriculture. Farmer's Bulletin* No. 599, 27 pp. + 9 figs. Washington, July 6, 1914.

Hog pastures in the Pacific Northwest of the United States are generally managed in one of the three following ways: 1. — Continuous close

razing. 2. — Alternate pasturing of equal areas. 3. — Pasturing the meadow on which hay is made also.

With the first method all the hogs the pasture will support are turned in it and left there during the entire season.

The second method consists in dividing the pasture into two or more fields of equal area, which are used alternately every week or ten days. In the case of clover and alfalfa the growth is allowed to become 3 to 4 inches high before the hogs are turned in. When the pasture consists of rape, kale, and vetch, the growth is permitted to reach a height of 8 or 10 inches before the hogs are turned in. A pasture thus subdivided is capable of carrying a much larger number of hogs per acre. Immediately the hogs are removed the pasture is clipped with a mower and sometimes irrigated. The third method consists in using clover and alfalfa for both pasture and ley at the same time. The number of hogs turned to graze is so limited that the usual crops of hay are made. When the forage becomes too large to furnish desirable feed a sufficient area near the watering place is clipped with a mower.

In a few days the clipped area produces a vigorous growth of new shoots upon which the hogs feed without disturbing the rest of the meadow. If necessary more of the meadow is clipped as required. Different portions of the meadow are used in this way from year to year.

Mature breeding stock that is not expected to make any gain in weight requires but little if any additional feed when on good pasture. But hogs which are to be marketed for pork must be fed some concentrated food.

If they are to be sold when 7 to 9 months old, in order to make them reach the weight demanded by the market (170 to 225 lb.) it is necessary to feed them all the grain they will consume. Hogs that are marketed when 10 to 12 months old get a much lighter feed of grain (from 1 to 3 per cent of the live-weight of the hog) or none at all during the grazing season.

Sometimes, instead of feeding the grain, the hogs are turned into a standing field of wheat, barley, peas or corn and allowed to feed it will until the crop is consumed. If they are provided with water, shade and salt, they require very little other attention, which saving of labour is very desirable during the busiest season of the year. This method is especially useful on the poorer soils, where the cost of harvesting is relatively high in comparison to the value of the crop and where the addition of more organic matter is very beneficial. The straw, pea-vines or corn stalks are cut in the autumn by a sharp disk harrow and ploughed in.

Wheat is generally hogged off for four to six weeks from about the stiff-dough stage. A soft variety of wheat with a smooth club type of head is the best for this purpose. The writer mentions two cases in which hogs pastured on wheat made an average gain in weight of 160 lb. and 212 lb. per acre, valued respectively $ 14.40 and $ 15.73 per acre, while the wheat alongside yielded 15 and 19 $^{3}/_{4}$ bushels per acre, the latter giving a net value of only $ 8.04 per acre.

Field peas are one of the most satisfactory crops to harvest with hogs, which utilize them with very little waste. They may be used from the time

TABLE I. — *Crops for Western Oregon and Western Washington.*

Crops	When planted	Approximate date when used	Number of hogs an acre will pasture
Pasture crops.			
Clover	A previous year	April 1 to November 1	8 to 16
Alfalfa	do.	do.	8 to 16
Rape in rows	April 1, 15 and 30	June 1 to November 1	8 to 14
Rape and oats	April 25 to May 15	June 25 to November 1	6 to 15
Rape and clover	May 15 to June 1	July 1 to November 1	6 to 15
Rape	July (in corn at last cultivation)	October 1 to April 1	5 to 8
Vetch and wheat, vetch and oats, or vetch alone	do.	do.	5 to 8
Vetch and wheat or vetch and oats	September (on spring stubble)	November 1 to April 1	5 to 8
English rye-grass	Early spring or early fall	November 1 to July 1	5 to 14
Winter wheat	September 1 to October 15	February, March and April	6 to 12
Vetch	September.	March to July 1	8 to 16
Grain crops.			
Beardless barley	Early spring	July 1 to July 20	—
Winter wheat	September and October.	July 10 to August 10	—
Field peas	Early spring	July 25 to October 1	—
Maize	April 20 to May 10	September 15 to November 15	—
Succulent winter feeds.			
Kale	Sown in March or April; transplanted in June.	October 1 to April 1	—
Squash	May 25	November 1 to January 15	—
Roots	April 1 to May 15	November 1 to April 1	—
Artichokes	Early spring	do.	—

TABLE II. — *Crops for the subhumid districts.*

Crops	When planted	Approximate date when used	Number of hogs an acre will pasture
Pasture crops.			
Winter wheat	Early in September	October 15 to November 15, March 15 to June 1.	5 to 8
Clover	April, previous year	April 10 to December 1	8 to 15
Alfalfa	A previous year	April 15 to November 15	8 to 15
Kale or rape	April and May.	June 15 to December 1	8 to 15
Rape and clover	May 1	July 10 to November 15	6 to 14
Winter wheat	Early in May	June 1 to November 15	6 to 15
Wheat in maize	July 15 to 20 (at last cultivation of corn)	September 15 to November 15	6 to 12
Stubble field		August 25 to April 1	—
Grain crops.			
Beardless barley	Early spring	July 5 to August 1	—
Winter wheat	September and October	July 20 to August 20	—
Field peas	Early spring	July 10 to November 1	—
Spring wheat	do.	August 1 to September 1	—
Maize	May 1 to 20	September 1 to November 15	—
Blue barley or common beardless barley	Early spring	From beginning of autumn rains to midwinter	—
Winter feeds.			
Alfalfa hay	A previous year	November 1 to April 15	—
Sugar beets, mangolds, carrots, rutabagas	April and May	do.	—
Artichokes	April	October 15 to May 1	—
Unthreshed or bundle wheat	Autumn or spring	Late autumn, and early spring	—
Field peas (unthreshed)	Early spring	do.	—
Unthreshed or bundle barley	Autumn or early spring	do.	—

TABLE III. — *Crops for the arid and semi-arid districts.*

Crops	When planted	Approximate date when used	Number of hogs an acre will pasture
Pasture crops.			
Winter wheat	October	April 1 to May 15	6 to 10
Beardless barley	February or March	May 1 to June 15	5 to 10
Spring wheat	March	May 1 to July 1	5 to 10
Winter wheat or beardless barley	May	June 15 to August 1-25	5 to 6
Field maize and Early Amber sorghum	April 10 to May 10	July until autumm frosts	4 to 7
Stubble field		August 25 to April 15	—
Grain crops.			
Beardless barley	Early spring	June 20 until autumn rains begin	—
Winter wheat	October	July 1 » » »	—
Spring wheat	Early spring		
	February and March	July 15 » » »	—
Field peas	do.	July 20 » » »	—
Blue barley or the common beardless barley	do.	October 15 to February 10	—

TABLE IV. — *Crops for the irrigated valleys.*

Pasture crops.			
Red clover	Previous year	March 25 to November 10	10 to 20
do. with wheat, oats or barley	Early spring	After grain is harvested to Nov. 10	10 to 20
Alfalfa	Previous year	April 1 to November 1	10 to 20
Grain crops.			
Beardless barley	Early spring, April	August 1 to November 15	—
Club wheat	September or October	August 5 to September 15	—
Field peas	Early spring, April	August 20 to November 15	—
Club wheat	do.	August 20 to October 1	—

PIGS

the last peas are nearly mature until about October or until the beginning of the autumn rains.

Carefully conducted tests at the Minnesota Experiment Station show that hogs waste no more corn in the field than when fed in lots, and that they gather it as clean as most men do in husking. Farm experience bears out this conclusion, especially if a movable fence is used and the hogs are not turned into more corn than they can consume in 15 or 20 days.

For summer and early autumn hogging-off, common early-sown beardless barley is used. For late autumn and winter use the more productive bearded varieties are preferred, after the autumn rains have softened the beards and kernels.

The tables (pp. 1642-1644) give some data on the pasture crops used in Western Oregon and Western Washington.

1154 – **Pig Feeding Experiments in Germany.** – KLEIN, in *Milchwirtschaftlicher Zentralblatt*, Year 43, Part. 47, pp. 452-458. Hanover, September 1, 1914.

Experiments were made with the object of ascertaining whether fish meal freed from fat and dried yeast can take the place of skimmed milk in the fattening of pigs.

In an eight-weeks preliminary experiment, three young pigs were given only skimmed milk besides a basal ration of potato flakes and barley; ten other young pigs divided into two equal groups were given the same ration as the preceding three, with the difference that a part of the milk was replaced in one lot by fish meal and in the other by yeast. One gallon of skimmed milk was always replaced by ½ lb. of fish meal + ½ lb. of potato flakes, or by 1 lb. of yeast. The course of the experiment was normal. The increase of live-weight per day and per head was as follows:

	lbs.
Lot I	1.24
» II	1.10
» III	1.13

The lower result yielded by the group fattened with fish meal is perhaps due to the lower amount of protein in the ration.

In a following experiment lasting 12 weeks the same pigs (minus one, which was eliminated) were divided into three equal lots. The rations were the same as in the preparatory period, with the difference that lot II had all the skimmed milk replaced by fish meal and that an extra quantity of fish meal + potato flakes was given to replace the skimmed milk. Further the yeast was steeped in warm water. The animals fattened with skimmed milk showed in general the greatest appetite, those fed with yeast the smallest. With this exception the course of the experiment was normal. The following is the increase of live-weight per day and per head.

	lbs.
Lot I.	1.44
» II	1.42
» III.	1.39

The small difference in the three lots leads to the conclusion that the fish meal and yeast produced almost, if not exactly, the same effect as skim milk. Yeast and fish meal, but especially the former, gave a better result with the older pigs than with the younger ones. As regards fish meal, this is probably due to the fact that the older animals gain chiefly in fat and are satisfied with less protein than the younger ones, which have to form flesh also.

From the economical point of view the principal experiment yielded the following results. If for the skim milk the values of 1.07 *d* or 1.6 *d* per gallon be assumed, and for the other feeds the prices actually paid on the market (fish meal 10*s* 6*d*, yeast 11*s* 6*d*, potato flakes 8*s*, and barley 7*s* 6*d* per cwt.), the cost of 1 lb. of gain in live-weight will be as follows :

Cost of skim milk per gal.	Lot I	Lot II	Lot III
	d	*d*	*d*
1.07 *d*	3.53	3.69	3.69
1.60 *d*	3.85	3·69	3.90

In general these results are in favour of fattening with skim milk if this is valued at the low price of 1.07 *d* per gal. If the skim milk be valued at 1.6 *d* per gal., the best results are obtained with fish meal and the less favourable ones with yeast. But if the greater dietetic value of skim milk be compared with this result, the conclusion may be drawn that skim milk valued at 1.6 *d* per gal. is at least as advantageous for young pigs as for the older ones. Whenever skim milk may be purchased at a price below 1.6 *d* per gal. its substitution by fish meal or yeast does not offer any advantage.

The carcase weight and the quality of the flesh were the same in the three lots.

BEES

1155 – **Apiculture in Uganda.** – *Communicated by the Acting Director of Agriculture, Uganda.*

In 1907, Sir H. Hesketh Bell, K. C. M. G., Governor of Uganda, being impressed by the value of the exports of beeswax from German East Africa, decided to introduce the industry into the Uganda Protectorate.

In August 1908 two natives of Uganda were sent to German East Africa to study the methods of preparation of beeswax followed in that territory. These men spent two months in German territory. On their return to Uganda they were sent out to instruct the peasantry in the preparation of wax.

The introduction of the beeswax industry was taken up in every district of the Protectorate. The idea was to put up log hives and encourage wild bees to take up their quarters in them. Tens of thousands of these hives were put up all over the Protectorate. Pamphlets were published in several native languages, and beeswax instructors were appointed to all the districts. The following statement shows the exports of beeswax from the Protectorate for the last five years :

Year	Lbs.	Value
1909–10	4 043	£ 154
1910–11	3 950	£ 162
1911–12	3 539	£ 162
1912–13	2 352	£ 117
1913–14	882	£ 42

There are several reasons for this failure of the effort to introduce a new industry. The quantity of wax obtainable from a hive of wild bees in Uganda is very small, several hives have to be taken to produce a small cake of wax. The natives found the taking of the hives unpleasant and the preparation of the wax laborious ; and since, when the process was complete, they got a smaller return than from any other method of earning money, the extraction of beeswax never became a popular industry. In fact, nearly all the wax which was produced was prepared by the beeswax instructors who were paid by Government to teach the peasants.

The following is a brief account of the methods employed : " Log hives were put up in the branches of trees and a few of these were tenanted by bees. When the hives were nearly full, the bees were smoked out and the comb was taken. The brood comb and a small amount of honey comb were left in the hive. The honey was then squeezed out of the comb, and the comb was boiled. The floating wax was drawn off and strained. The wax was subsequently broken up and clarified by melting and straining ".

1156 – **The Silk Weaving Industry of Amarapura, Burma.** — SHROFF, K. D., in *The Agricultural Journal of India*, Vol. IX, Part III, pp. 254-287 + 6 plates. Calcutta, July 1914. SILKWORMS

Sericulture in Burma has been almost exclusively in the hands of a curious race of people, the Yabeins, who numbered about 2 197 in Lower Burma in 1891.

It also exists to a small extent in Upper Burma and the Shan States. The rapid decline of the industry is shown by the decrease in the number of silkworm breeders from 3102 in 1891 to 211 in 1911.

This decline is attributed to the following causes :

1). The crude and careless system of rearing and inter-breeding and consequent degeneracy of the breed.

2). The ravages of diseases.

3). The imperfect knowledge of the reeling of the silk and the consequent production of coarse, uneven thread unsuitable for local consumption or export.

4). The abundance, the cheapness and the superiority of the imported raw silk.

Raw silk is imported from the Straits Settlements, Siam, Indo-China, China and Japan. The value of the silks imported decreased from 29 15 805 Rupees (£195 000) in 1898 to 14 18 306 Rupees in 1910, but since then it has increased to 31 44 189 Rupees (£ 209 000) in 1913.

The imports from China appear to be supplanting those from the Straits and elsewhere.

These figures do not support the opinions that the weaving industry of Burma is in a decadent condition owing to the competition of finished machine-made products. In 1911 there were no less than 18 621 people engaged in silk spinning and weaving.

The writer gives an account of the types of silk and handlooms used by the Burmese, and descriptions of their designs. A cooperative credit society has been established, and improved methods of manipulation and handlooms are being introduced.

1157 – **Researches in Sericulture in Cambodia.** — De Flacourt, Martin (Chef des Services Agricoles et Commerciaux du Combodge), in *Gouvernment Général de l'Indochine, Bulletin économique de l'Indochine*, Year 17, No. 108, pp. 388-389. Hanoi-Haiphong, May-June 1914.

Since April 1913, the Agricultural Service of Cambodia has undertaken the work of improvement by systematic selection of the pure native breeds of silkworms. It was therefore decided that the Service would not purchase any more foreign cocoons for the production of eggs, but produce them all in its own farms. With this object in view the Silkworm Breeding Station at Petit-Takéo conducted the breeding work in three lines: 1) pedigree or line breeding ; 2) reproduction from eggs selected from the best cocoons of the pure lines ; 3) the breeding of the best cocoons for industrial purposes.

The results obtained from one year's work give every confidence for the ultimate success of this method. Two local breeds (one a white worm with yellow cocoon known as Tân Châu, and the other a greenish yellow worm with golden yellow cocoon known as Tâm-sé) were brought to a state of absolute purity and improved with respect to increase of specific gravity of the cocoons and increased fecundity of the females. Thus, whereas it formerly required 1635 cocoons of Tan Châu or 1870 cocoons of Tam-Sé to weigh one kilo (three days after the worms begin to spin), at the end of the breeding experiments in February and March 1914 it required only 970 and 1355 cocoons respectively. During the same period the egg-laying capacity of the females was increased from 275-350 per day to 400-475, with a maximum of 500-550, that is to say, that, according to local methods of calculation, the weight of cocoons from the eggs of 100 females would weigh from 55-66 lb. to 75-105 lb. The average price of 100 batches of eggs decreased from about 1*s* 3*d* to 6*d* and the demand for supplies from the natives increased enormously.

These experiments at Petit-Takéo lead to the belief that pébrine has a marked tendency to diminish and disappear in Cambodia, because the local conditions are undoubtedly unfavourable to the completion of the life-cycle of the disease, owing to the rapid evolution of the silkworms (40 days being sufficient for the complete development of the two local breeds). Very badly diseased eggs (showing 200 corpuscles of pébrine in the field of the microscope) have been bred and reared with healthy eggs of the same breed. Only the new generations showing the most disease were reserved. It was found that not only the number of corpuscles gradually diminished, but cocoons have been obtained from the diseased eggs almost

equal to those from the healthy control lots and after 6 successive generations only 1½ per cent of the individuals were diseased, showing only 6 to 8 corpuscles in the field of the microscope.

FARM ENGINEERING.

1158 – **Motor Tillage Machine with Oscillating Spades turning Sideways.** — *Kaiserliches Patentamt, Patentschrift* No. 273 777. Berlin, May 7, 1914.

Several digging machines with movable spades have been constructed. In some the spades are attached to revolving drums and are driven into the

Fig. 1.

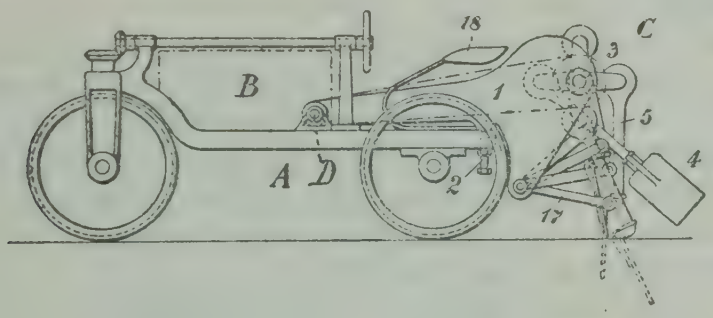


Fig. 2.

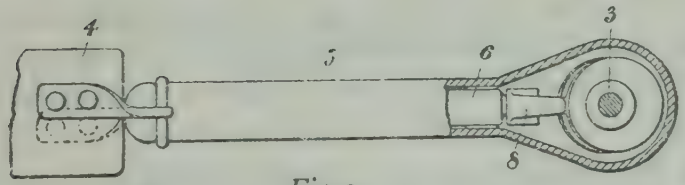


Fig. 3.

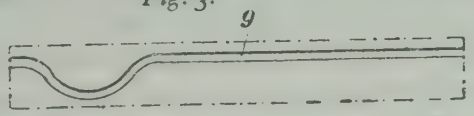
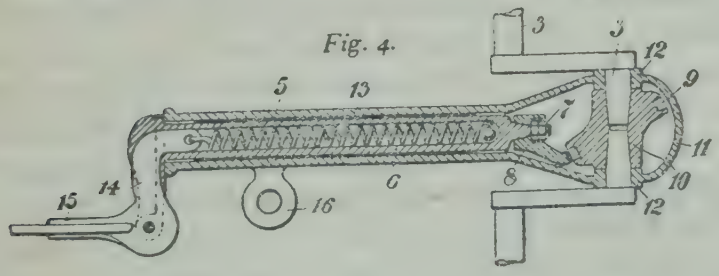


Fig. 4.



Motor Digger.

Soil

siol by the weight of the machine. In others they are independent of each other and move up and down by an excentric. In both types the spades have also a lateral movement calculated to turn over the earth as it is spaded.

In this machine patented by H. Kleinert in Germany under No. 273 777 the spades oscillate on a crank shaft and turn sideways to discharge and turn over the earth. Fig. 1 shows a side view of the machine and figs. 2, 3 and 4 some of its details. B is the motor, mounted on the truck frame A, which propels the machine and drives the spading appliance C, which is borne by two side plates (1), the front end of which is fixed to the frame in D by pivots ; the other extremity can be raised or lowered by the screw (2).

The plates (1) carry the bearings of the crank shaft (3), each crank of which bears a spade holder(5). The cylindrical part of these holders contains the handle (6) of a spade (4), which is fastened to a knee piece working on a bolt situated on a lateral extension of the handle, the other end of the knee piece being attached to a spring (13) inside the handle (6). The upper end of this bears a head piece (8) carrying a roller that runs in a groove (9) in the head (10), which is fixed to the crank of the shaft (3) and which joins the two portions of the same crank (3). Each of these heads is enclosed in a case (11) fitted with two bearings (12). The case, which efficiently protects the mechanism against dust, earth, etc., is provided with means of lubricating the working parts to ensure smooth running.

On the outside of the holders an eye (16) is fixed for the reception of one end of the lever (17) (fig. 1), the other end working on a shaft, common to all the levers, fixed in the side plates.

When at work these spades are situated with their face to the direction in which the machine travels ; as soon as they are raised they begin to turn sideways and thus discharge and turn the earth over. This turning motion is effected by the roller in the groove (9) of the head (10) ; the development of the groove is shown in fig. 3.

The spring (13) allows of stones and similar obstacles being encountered in the soil without causing injury to the machine.

1159 – **The Rapid Drying and Preservation of Wood by Nodon's Electrical Process.** — DANTIN, CH., in *Le Génie Civil*, Vol. LXV, No. 5, pp. 98-101. Paris, May 30, 1914.

M. Albert Nodon, the electrician, has been studying since 1896 the subject of the rapid drying and preservation of wood, and has now perfected his system and rendered its application practical. He had discovered that a current of electricity sent through wood set up chemical, physical and aseptic actions which led to its preservation ; the first of these consists chiefly in a complete and rapid oxidation of the resinifiable substances contained in the sap. The physical action caused a molecular transformation in the cellulose and its numerous derivates, modifying their mechanical and putrescible properties and rendering them resistant to destructive germs coming from without. Lastly, the aseptic action consists in the complete destruction of all the germs of corruption, such as ferments, bacteria, fungi, etc., contained in the wood. Besides the above effects it has been found that " nodonized " wood withstands the attacks of injurious insects, such as termites, which no longer find in it their usual food.

One of the most important desiderata in the timber trade is the rapidity of seasoning timber, for any long stay in the timber-yard means an immobilization of considerable capital. Consequently the use of heated and

ventilated esiccators is often resorted to, but such esiccation is mostly only superficial and on exposure to the air moisture is again absorbed. As the presence of sap hinders esiccation, steam at high temperatures and under pressure is often used to remove it, but this process is injurious to the resistance, tenacity and preservation of the wood and renders it inferior to air-dried wood. Besides, these processes of esiccation are expensive, as they entail costly plant, and much fuel and labour.

M. Nodon's process, or "nodonization", on the contrary, causes in a few hours the complete oxidation of the sap, which in air-drying requires

Fig. 1.

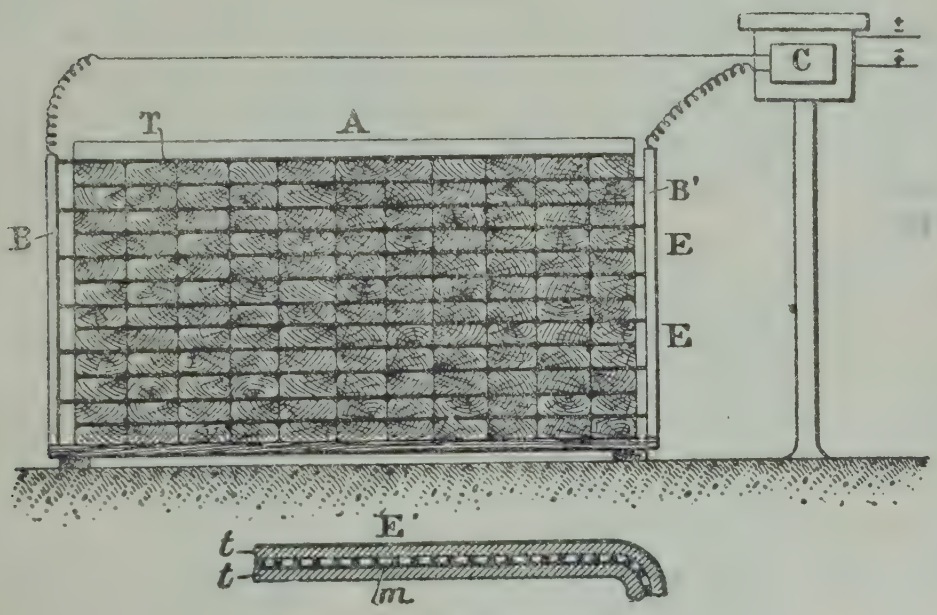


Fig. 2.

Fig. 1. — Section of a stack of railway sleepers under treatment.

Fig. 2. — Section of electrode mat.

B B[1]. Conductors to the mats.

C. Current distributor.

E. Electrode mats.

T. Sleepers.

m. Wire net.

tt. Jute cloths.

such a long time; the substances other than cellulose, even in the innermost portions of the wood, are transformed into resins and completely deprived of their hygroscopicity; thus nodonized green wood loses its moisture rapidly on exposure to the air, while untreated wood dries only on the surface during the same time.

This process can also be applied to unbarked timber even 5 or 6 months after felling, as it still contains enough sap and moisture to conduct electricity.

The green timber to be treated, if in planks, railway sleepers, etc., is stacked to a height of three to five feet in layers separated from each other

by electrode mats in which the current passes (fig. 1). The mat (fig. 2) which can be rolled up for transport, consists of a pliable galvanised iron wire netting placed between two strong jute cloths. These mats are stretched between the tiers of timber and saturated with water to render them good conductors; the wire nets are connected with electric conductors the poles of the mats being alternated so that the current may pass through the thickness of each layer.

The conductivity of wood varies considerably with its kind, thickness degree of moisture, etc. Its resistance varies from 6 to 20 Ohms per cubic meter (35 cub. ft.), but it remains fairly constant throughout the duration of the treatment. Continuous currents may be used, but alternating currents are preferred. Treatment in the forest where the timber is cut is very advantageous when the wood is in full sap and in summer. The trees are cut up by electric saws driven by a dynamo and a portable engine stoked economically with the waste wood; after being nodonized, the timber is stacked in a place exposed to the wind where it dries completely in a few weeks.

The duration of the treatment varies between one and two full days according to the kind of wood and the use to which it is to be put. When treated too rapidly the wood is liable to split, though its keeping qualities are the same as if it had been treated slowly.

The total quantity of current that 1 cub. metre (35 cub. ft) of wood must have for its complete treatment is 150 Ampère-hours. Wood in full sap does not require above 40 volts electro-motive power, while for unbarked wood that has been kept some time 80 to 100 are necessary.

Nodonized wood is freed from starch and contains resinified substances throughout its whole mass, and its cells present a characteristic regularity. These changes allow nodonized timber to be easily distinguished from that which has not been treated.

The cost of the plant consists in the source of the alternating current and in the electrode mats; the latter cost about 4*d* per square foot, and they last about a year. As 3 sq. feet are required for the daily treatment of 1 cub. foot of wood, the cost of the mats is about 0.03 *d* per day per cubic foot.

The cost of nodonizing wood is bout $^3/_4 d$ per cubic foot, when the work is done in the forest, fuel, carriage and general expenses being cheaper than in factories, where the cost amounts to a trifle over 1*d* per cubic foot.

The process is useful wherever wood is used: in ship building, railway construction, carpentry, etc. The Municipality of Bordeaux has officially recognised that nodonized wood used for road paving lasts longer and wears better than untreated wood.

1160 – **A Latex Hydrometer.** — EATON, B. J., in *The Agricultural Bulletin of the Federated Malay States*, Vol. II, Nos. 9 and 12, pp. 224-226 and 314-322. Singapore, April and July 1914.

Messrs J. J. Griffin and Sons, scientific apparatus makers, Kemble Street, Kingsway, London, have constructed from detailed instructions

given by the writer, a delicate glass hydrometer graduated at 84° F. An average pure latex containing about 30 per cent of rubber has a density of about 0.98. A latex containing about 35 per cent of rubber is so viscous as to render it impossible to test its density directly. It is therefore recommended in such cases to dilute with an equal volume of water. The rubber content will then be double that corresponding to the density of the diluted latex.

Among the various services that this instrument can render is that of allowing the latex to be diluted with water to such an extent that its density will be constant. In this way very uniform results can be obtained in the preparation of smoked sheet. A satisfactory density figure at which to work is 0.9898, indicating a latex containing 15 per cent of rubber.

1161 – **New Water-Raising Device.** — *Les Inventions Illustrées*, Year 17, No. 11, p. 3. Paris, April 30, 1914. — *Engineering*, Vol. XCVIII, No. 25232, p. 10. London, July 10, 1914.

Among the smaller machines exhibited at the Royal Agricultural Society's show held at Shrewsbury this year, a very interesting water-

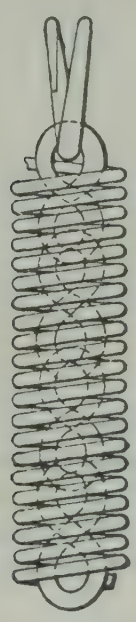


Fig. 1

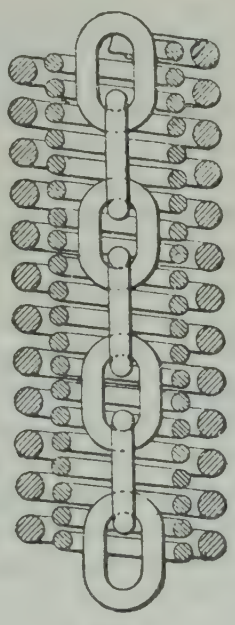


Fig. 2

New Water-raising Device.

raising device was exhibited. This appliance is virtually a chain pump, with nothing but the loop of an endless chain depending into the well. To keep the chain in place a deep rimmed pulley is slung in the lower loop of the chain. At the top end the chain is run over a pulley wheel worked by gearing. This pulley is enclosed in a casing with a delivery pipe leading away from the lower portion. The chain consists of a link chain surrounded by a spiral, fig. 1, and for larger capacities by a multiple spiral, fig. 2. The lower part dipping into the well catches up the water while the spiral is opened by the curvature of the pulley, and retains the bulk of it till the highest part is reached, when the centrifugal force, while the spiral is

bent open at the top pulley, throws the water out into the casing, whence it flows away. The capacity of this simple appliance is surprising, and it will handle water from considerable depths. The apparatus requires no permanent fixtures in the well at all, no buckets, guides, etc.

A double spiral 1. 7 inches in diameter with a 5 HP motor is said to draw up from a depth of 196 feet 2090 gallons per hour.

At a depth of 33 feet a triple chain 2.48 in. in diameter can deliver 5060 gals. per hour with 2.4 HP. For wells in which the level of the water varies, the chain is made up in lengths which can be readily joined together by special hooks, so that about 2 feet of the chain should always dip into the water, with which immersion it has been found to give the best yield.

On account of its simplicity this pump is not expensive; it is easy to transport and to set up without skilled artisans.

1162 – Review of Patents.

Tillage Machines and Implements.

Austria	67 408. Device for regulating the depth of tillage machines with rotary implements.
	67 402. Device for coupling agricultural machines to their tractor.
Canada	155 001. Motor plough.
	155 071. Gang plough.
	155 124, 155 488, 155 635. Cultivators.
	155 137. Clod-crusher.
	155 138. Traction belt for motors of the Caterpillar type.
	155 139. Traction machine.
	155 250. Plough with concavo-convex disk.
	155 357. Reversible plough.
	155 373. Weeding tool.
	155 393. Pulverizer for soil.
	155 412. Plough disk.
France	470 503. Device for increasing the stability of balance ploughs.
Germany	276 371. Ploughing machine with oscillating shares working backwards.
	276 412. Tillage machine with rotating drum carrying spades.
	276 446. Stone collector with elevator screen and conveyor.
	276 447. Adjustable cleat for driving wheels of motor ploughs and the like.
	276 684. Cultivator share.
	276 828. Shaft with hoes for hoeing machine.
	277 065. Device for pulling and steering implements, especially for agricultural purposes.
	277 123. Device for lifting the chains of tillage implements attached to and drawn by levers.
	277 473. Plough with beam that can be raised or moved sideways.
	277 474. Tillage machine with oscillating spades driven by a crank shaft.
	277 475. Device for lifting and lowering, by power, agricultural implements.
	277 610. Driving wheel for agricultural machines with moveable cleats fastened to the inside of the tyre.
Switzerland	66 441. Tillage machine.
	66 443. Spades with adjustable blades.
	66 863. Cultivator share.
	67 056. Plough share.

United Kingdom 10 969. Thinning machine, cultivators.
11 270. Digging machine.
12 780. Detachable point for protecting the points of the mould-board share and landside plate of a plough.

United States 1 106 603. Mechanically propelled plough.
1 106 722, 1 108 286, 1 108 319, 1 109 438, 1 109 661. Cultivators.
1 106 742. Caster wheel truck attachment for cultivators.
1 106 529. Motor plough.
1 106 389. Attachment for plough guards.
1 106 582. Plough beam.
1 107 173. Weeder for harrows.
1 108 600. Cultivator tooth.
1 108 261, 1 109 442, 1 109 813. Harrows.
1 108 787. Self-propelled ploughing machine.
1 109 076. Automatic guiding device for harrows.
1 109 095. Combined plough and cultivator.
1 109 535. Sulky plough.
1 109 063. Subsoiler.
1 108 909. Harrow tooth fastener.
1 109 084. Plough-lifting mechanism.
1 109 806. Gang plough.
1 109 756. Combined plough and fertilizer distributor.

Manure distributors, etc.

Canada 155 182. Manure loader.
155 300, 155 418. Manure spreaders.

Denmark 19 063. Liquid manure distributor.

Germany 277 030, 277 477. Manure distributors.

Switzerland 66 654. Manure distributors.

United Kingdom 10 786. Apparatus for distributing insecticides, manures, etc., by means of an air blast.
11 588. Manure distributor to be mounted on ploughs.

United States 1 108 263. Fertilizer distributor.
1 108 150. Manure spreader.
1 109 896. Straw spreading attachment for manure distributors.

Drills and Sowing machines.

Austria 67 401. Sowing machine.

Canada 155 059. Potato planter.

Germany 276 303, 276 576. Potato planters with device for making holes.
276 866. Agitator wheel arrangement for drills.
277 066. Sowing machine in which the seed issues from holes in the side of the hopper.
277 201. Device for pressing and covering the seed, applied to drills.
277 029. Drill and dibble.

Switzerland 66 656. Apparatus mounted on wheels, for sowing in heaps, with knives to remove weeds and shares to open furrows.

United Kingdom 11 155. Potato planter.
12 844. Seed and like distributors.

United States 1 106 737. Combined disk harrow and seeder.
1 106 373. Corn planter.
1 109 835. Corn planter.

United States 1 107 044. Cotton planter.
1 108 130. Seed planter.
1 108 435. Furrow opener for corn planters.
1 108 878. Planter.
1 109 711. Drilling attachment for disk harrows.

Reapers, mowers and other harvesting machines.

Canada 154 990. Motor harvester.
155 017. Hop-gathering machine.
155 032, 155 618. Mowing machines.
155 149. Carrier for harvesters.
155 179. Grain shocking machine.
155 405. Draft mechanism for harvesters.
155 600. Stacker hood.
France 470 498. Improvements in horse rakes.
Germany 277 124. Device for tilting and raising the cutter-bar in mowers.
277 315. Cutter-bar for mowers.
277 459. Scythe eye with adjustable excentric fastening.
Switzerland 66 444. Mower with fore-carriage.
66 445. One-horse side-delivery swathe rake.
66 657. Device on mowers for cleaning the blades.
66 864. Cutter-bar for mowers.
66 865. Scythe.
66 959. Apparatus for automatic loading of hay carts.
United Kingdom 10 793. Grass box for mowing machines.
11 508. Motor mower.
11 582. Tedding attachment for mowers.
12 397. Horse-rakes.
12 586. Aprons for harvesting machines.
12 766. Appliance for collecting and cocking hay.
13 320. Harvesting machine.
United States 1 107 083 Cotton harvester.
1 106 652. Sheaf loader.
1 108 536. Vertical mower.
1 108 150. Mowing machine.
1 109 525. Nozzle for cotton pickers.
1 110 158. Cotton picker.
1 109 711. Hay gathering and stacking machine.
1 109 687. Harvester.
1 109 897. Hay-rake.
1 109 688. Corn harvester and husking machine.
1 109 664. Hay pitcher.

Machines for lifting root crops.

Austria 67 403. Device for holding beets in beet-topping machines.
Canada 154 924. Potato digger.
Denmark 19 249. Machine for loading beets.
United States 1 106 668. Potato harvester.
1 108 341. Combined beet puller and topper.

Threshing and winnowing machines.

United Kingdom 12 828. Improvement in beater of threshing machines.
13 082. Threshing machine.
United States 1 109 428. Seed cleaner.

Other agricultural machines and implements.

Austria
67 302. Butter worker with intermediate gear.
67 530. Lid for milk pails.
67 531. Butter pressers.

Canada
154 881, 154 882. Baling machines.
154 928. Churn.
154 979. Sheaf loader.
154 998. Milk cooling and bottling apparatus.
155 009. Tool handle.
155 153. Milk separator.
155 156. Tractor.
155 157. Sprayer for plants.
155 233. Butter moulding apparatus.
155 267. Milk can.
155 323. Rossing machine.
155 449. Fibre breaking machine.
155 643. Traction belt.
155 652. Animal trap.
155 658. Peat working machine.
155 727. Machine for sharpening millstones.
155 759. Baling press.
155 797. Hay press.
155 835. Poultry feeder.
155 842. Incubator.

Denmark
19 062. Device for milking machines.
19 064. Machine for singling beets.
19 229. Apparatus for freeing animals in stables.
19 234, 19 280. Automatic straw presses.
19 273. Apparatus for heating milk for a certain length of time.

France
470 945. Stand for drying hay.

Germany
276 305. Apparatus with agitator for extracting wax from empty honeycombs.
276 448. Central cone for milk separators, formed of several rings kept together by adhesives.
276 577. Potato peeling machine.
276 641. Drum for milk separator.
277 067. Adjustable nozzle.
277 096. Incubator with automatic heat regulator, cooler and ventilator.
277 225. Apparatus for rendering milk and other liquids homogeneous.
277 381. Apparatus for catching insects.
277 476. Machine for excavating ditches, canals, etc.
277 575. Fore-carriage for agricultural machines.
277 576. Milk skimming pan.

Switzerland
66 442. Appliance to keep agricultural machines mounted on wheels at the proper distance from the power machine.
66 446. Supports for strawberries.
66 447. Feeding trough.
66 448. Apparatus for untying cattle.
66 449. Cattle drinking trough closing automatically.
66 728. Curd-cutter.
66 961. Adjustable railing for feeding troughs in stables.

United Kingdom
10 772. Machine for gauging and sorting corks.
11 002. Milk cans.
11 164. Propagation and seeding boxes.
11 220. Hopper truck for spreading tea to be dried, fermented, etc.
11 224. Appliance for gathering fruit.
11 271. Traction engine.
11 321. Shoots for conveying sacks.
11 398. Luminous paint lamp-trap for insects.
11 401. Horticultural frames.
11 411, 11 518, 11 726. Cow-milkers.
11 705. Machine for stemming tobacco leaves.
11 931. Apparatus for hulling coffee, grinding maize, wheat, etc.
11 977. Implement for tapping rubber trees.
12 138. Apparatus for extracting oils by means of volatile solvents.
12 141. Megasse furnaces.
12 230. Baling press.
12 414. Machine for cleaning and sorting potatoes.
12 459. Machine for reducing oyster shells, spices, maize, etc.
12 736. Animal traps.
12 873. Combined incubating and rearing apparatus.
12 984. Trap for flies.
13 037. Separator for grain refuse.
13 240. Sack holders.
13 328. Churns.
13 436. Rotary malting drum.

Unitedi States.
1 107 001, 1 110 298. Tongue trucksi.
1 106 512. Hay carrier.
1 106 405. Plant replanter.
1 106 580. Hay press.
1 108 203. Levelling device for traction engine.
1 108 373. Ensilage machine.
1 108 325. Stalk puller.
1 108 163. Feeding device for feed cutters.
1 108 599. Baled hay conveyor and elevator.
1 109 456. Litter carrier.
1 109 429. Farm tractor.
1 109 294. Tractor wheel.
1 108 882. Bug and worm collector.
1 109 752. Wagon steering gear.
1 109 789. Wagon loader.
1 109 687. Seed germinator and plant forcer.

BUILDING CONSTRUCTION

1163 – **Bold Concrete Dam.** — *Engineering Record*, Vol. 69, No. 25, p. 693. New York, June 20, 1914.

In 1907 a dam was built, on a firm lava rock, across the Crowley Creek in Idaho, U. S. A., for irrigation and domestic needs. It is 55 feet high and its plan is a curve of 72 feet radius, the convex side being turned up stream. It is of unreinforeed concrete and only 5 ft. 2 in. thick at the base and 3 ft. at the top. It has been found very satisfactory as it has had more than a foot of water flowing over it on several occasions.

Recently it has become desirable to increase the reservoir capacity, and a State permit has been granted for the raising of the original structure to a height of 90 feet. The thickness at the bottom will be increased to 9 ft. 2 in. and at the top to 3 ft. 2 in. The length of the crest will be 223 ft. At its central point it will be 1 foot lower than at the wing walls, towards which the crest slopes gently upwards so that the overflow tends to concentrate at the centre, but in flood seasons the entire length between wing walls becomes a spillway.

When filled to the 90 ft. level, the reservoir will cover 66 acres to an average depth of about 36.4 feet, storing 2400 acre-feet.

RURAL ECONOMICS.

1164 – **On the Selection of Crop Rotations.** — MARENGHI, E., in *L'Italia Agricola*, Year 51, No. 10, pp. 436-438. Piacenza, October 1914.

1. In the application of economics to agriculture the various difficulties which interfere with the realisation of the maximum profit may be classed as *objective* and *subjective*. The former are due to certain external conditions quite independent of the ability of the person directing the enterprise. The inevitable divergence entailed by many systems of cultivation from the most suitable type, is often due to the very specialised character of the land itself.

The possibility of re-organising agricultural exploitation is therefore subordinated, at least partly, to the special conditions prevailing. Generally, too rapid and radical changes are not possible since they involve loss of capital invested in the soil. For example, although it would be comparatively easy to replace one herbaceous crop by another in a short time, it would be more difficult to extend the forage area and still more difficult to replace one kind of woody growth by another. Admitting that agricultural exploitation can be modified with relative rapidity, no state of equilibrium can be reached, owing to the inevitable dynamism of all the economic factors.

2. The *subjective* difficulties, on the other hand, are due principally to the incapacity of the farmer.

The systems of cultivation suffer always necessarily from the great difficulty of forecasting coming economic events, previsions never being confirmed by facts.

3. A system usually followed, and which enables serious errors to be avoided, consists in adopting from time to time only those methods which tend to prevail and which therefore are presumably sanctioned by experience.

4. The systems predominating in the different zones should be regardad as attempts of the cultivators to realise a maximum profit. Though it is true that this is never completely realised, the predominating or general

system in vogue should be regarded as the best organised and the most remunerative.

The data for the solution of this problem can be obtained from various sources, amongst others, the Land Register, which indicates the distribution of the various crops in the different districts. From an examination of the distribution of crops in the hills and plains of Perugia it has been possible to deduce a rotation which fairly illustrates the subject in question.

5. It is presupposed that the different combinations of crops differ in one sense or another from that giving the maximum return; but this supposition corresponds only approximately to the facts. It often happens that all or almost all the combinations in question are affected by the same error, especially where too much importance is attached to established usage. Even in this case, however, much valuable information may be obtained by observation of facts.

6. Analogous results are more often obtained by the data furnished by statistical observations during a single year and grouped according to the ability of the various cultivators, which may be excellent, mediocre or bad.

The system of cultivation adopted by the most capable agriculturists and which consequently approaches the most remunerative, is a suitable model for the particular conditions of situation and time. But in this case also some reserve is desirable; for though in general the most progressive systems should be followed, it sometimes happens that excellent agriculturists make the same collective error of economic forecasting.

As an instance of this the writer mentions the vine-growing crisis in Apulia several years ago.

Similarly, statistical observation of crop systems has only a very approximate practical value, since it can only provide rather vague and schematic indications, though in any case more trustworthy than the data given by analytical book-keeping. The latter method is only suitable as a help — in the most favourable case — for the solution of small questions of detail and not for the tracing with any reliability of the fundamental basis of rotation systems, which must be selected in the various practical cases.

1165 – **Statistical Data on the Economy of the Farms Belonging to the Cooperative Book-keeping Association of Königsberg in Prussia.** (1) — GÜNGERICH, in *Georgine*, Year 7, No 51, p. 437; No 53, pp. 453-454. Königsberg, June 25 and July 2, 1914.

During the year 1912-13 the average distribution of crops in the 145 farms belonging to the cooperative book-keeping association was as follows: 19.8 per cent of the cultivated area was under winter cereals, 18.8 under spring cereals, 3.6 under pulse, 6.5 hoed crops, 46.8 forage crops, 2.1 fallow, and 2.4 per cent miscellaneous.

The capitals invested in the farms since the year 1904-05, the first

(1) See No 987, *B.* August 1913. (*Ed.*)

of the existence of the Association, have been, per acre of cultivated area, as follows:

Year	Number of farms	Buildings			Live stock			Dead stock		
		£	s	d	£	s	d	£	s	d
1904–05.	18	6	9	4	2	15	11 1/4	0	17	5 1/2
1905–06.	45	6	12	1 1/2	2	17	11	0	17	10 1/4
1906–07.	57	7	4	5	3	2	3 1/2	0	18	3
1907–08.	70	7	4	5	3	3	1	0	18	3
1908–09.	74	7	8	4 1/2	3	5	10 1/4	0	18	7 3/4
1909–10.	89	7	10	4 1/2	3	6	7 3/4	0	19	10
1910 11.	96	7	13	11 1/4	3	5	5 3/4	1	0	7 3/4
1911–12.	118	7	15	6 1/4	3	9	5 1/4	1	1	9 3/4
1912 13.	145	7	1	3	3	17	9 1/4	1	5	9 1/2

The decrease in the value of buildings during the last year is due to the fact that the value of the owner's residence is deducted from the total value of the buildings. The sudden increase in the value of the live and dead stock in the last year is caused by having reckoned as cultivated area only the fields, meadows, and pastures, while in the preceding years a portion of the areas occupied by yards, roads, ditches, and other waste land was also included.

The figures for the individual farms vary according to the degree of intensity of the farming; thus the capital in buildings ranges from about £4 to £12, that in live stock from £2 to £6, and that in machines and implements from £1 to £3.

If the figures for the individual farms be grouped according to the extent of the cultivated area, the following table is the result:

	Number of farms	Buildings			Live stock			Dead stock		
		£	s	d	£	s	d	£	s	d
Class I up to 617 acres .	34	7	9	2	4	10	6	1	16	1
» II from 620 to 1235 acres	58	7	2	5	4	2	1	1	5	0
» III » 1237 » 1852 »	31	6	17	3	3	3	6	0	17	6
» IV above 1852 acres . .	20	6	18	1	3	2	8	0	17	6

The average stock of live stock increased from about 16.6 head of large cattle per 100 acres of cultivated area in the year 1904-05 to 20.2

	Number of farms	Net profits	Returns	From live stock	From sale of produce	Sundries	Outlay	Purchase of live stock	Manures	Fodder	Salaries and wages	Upkeep of buildings and implements	Sundries	Value of wheat used in payments in kind
		£ *s* *d* per acre												
1911-12	118	1 8 9	4 10 10	2 8 5	1 14 11	0 7 6	3 4 3	0 13 6	0 9 6	0 9 6	0 17 3	0 5 11	0 11 6	0 5 4
Average of period 1904-05-1911-12	71	0 18 0	3 11 10	2 0 10	1 2 3	0 8 7	2 14 9	0 12 11	0 4 0	0 6 9	0 14 10	0 4 9	0 11 6	0 4 4
1912-13	145	0 15 8	3 18 2	2 11 2	0 19 10	0 7 2	3 5 1	0 12 4	0 7 6	0 9 11	0 19 10	0 5 7	0 9 11	0 5 2
Average of period 1904-05 1912-13	79	3 16 2	3 12 7	2 2 1	1 1 10	0 8 7	2 15 11	0 12 8	0 4 4	0 7 2	0 15 6	0 4 9	0 11 6	0 4 4

ead in 1912-13, while the number of draught animals has remained fairly onstant at an average of 4.2 head.

The year 1912-13 closed with considerably lower net profits than the preceding year 1911-12, and has thus lowered the average of the net profits, as may be seen from the table opposite, in which the net profits and the total turnover per acre, as average of all the farms, for the years 1911-12, 1912-13 and the periods 1904-05 - 1911-12 and 1904-05 - 1912-13 are shown.

The value of these farms, calculated by capitalising the average net profits at the rate of 4 per cent, amounts to about £20 per acre, which is considerably below the prices paid now for farms; in other words, the net returns obtained represent a low interest on the capital invested. If the landowner is to have adequate interest on his capital and to pay his private expenses, such as interest on debts, taxes, housekeeping, etc., out of the returns of his property, without loss, the average net returns should be, according to the writer, increased to at least £1 per acre.

1166 **Comparative Cost of Food for a Heifer, Stall-fed or at Grass, up to her First Calving.** — ZWANOWETZ, EDUARD, in *Wiener Landwirtschaftliche Zeitung*, Year 64, No. 68, p. 656. Vienna, August 26, 19 4.

The writer works out as follows the cost of food for a cow at two and a half years, according as she has been exclusively stall-fed or has been put out to graze in summer. (She is supposed to have been calved on the 1st of November).

TABLE I. — *Cost of Food for Stall Feeding.*

	£	s	d
1. Nov 1 to April 30, age ½ year			
132 gallons whole milk, at 8 ¼*d*	4	10	0
220 lbs. crushed oats and oatmeal, at 6*s* 9*d* per cwt.	—	13	4
880 lbs. tender meadow hay, at £2 2*s* 6*d* per ton	—	16	8
880 lbs. mangolds, at 12*s* 9*d* per ton	—	5	0
	£ 6	5	0
2. May 1 to Oct. 31, age 1 year			
814 lbs. oats, at 7*s* 8*d* per cwt.	2	15	6
1628 lbs. hay, at £2 2*s* 6*d* per ton	1	10	10
814 lbs. straw of spring grain, at 25*s* 6*d* per ton	—	9	3
3300 lbs. green fodder, at 8*s* 6*d* per ton	—	12	6
	£ 5	8	1
3. Nov. 1 to April 30, age 1 ½ year.			
405 lbs. rye bran, at 6*s* per cwt.	1	1	6
1210 lbs. dry fodder, at £2 2*s* 6*d* per ton.	1	3	0
1210 lbs. straw of spring grain, at 25*s* 6*d* per ton	—	14	0
4050 lbs. mangolds, at 12*s* 9*d* per ton	1	3	0
	£ 4	1	6
Carried forward	£ 15	14	7

	£	s	d
Bronght forward . . .	£ 15	14	7
4. May 1 to Oct. 31, age 2 years.			
202 lbs. rye bran, at 6*s* per cwt.	—	10	9
16 200 lbs. green fodder, at 8*s* 6*d* per ton	3	1	4
405 lbs. straw of spring grain, at 25*s* 6*d* per ton	—	4	7
	£ 3	16	8
5. Nov. 1 to April 30, age 2 ½ years			
405 lbs. rye bran, at 6*s* per cwt	1	1	6
814 lbs. dry fodder, at £2 2*s* 6*d* per ton	—	15	6
1628 lbs. straw of spring grain, at 25*s* 6*d* per ton	—	18	6
6070 lbs. mangolds, at 12*s* 9*d* per ton	1	14	6
	£ 4	10	0
Total cost of stall feeding	£24	1	3

TABLE II. — *Cost of Food at Grass.*

	£	*s*	*d*
1. Nov. 1 to April 30, age ½ year.			
As in Table I	6	5	0
2. May 1 to Oct. 31, age 1 year.			
Pasture, 184 days at 3*d*	2	6	0
3. Nov. 1 to April 30, age 1 ½ year			
As in Table I, but without bran	3	0	0
4. May 1 to Oct 31, age 2 years			
Pasture, 184 days at 4*d*	3	1	4
5. Nov. 1 to April 30, age 2 ½ years.			
As in Table I, but without bran	3	8	6
Total cost at grass	£18	0	10

Thus the difference in favour of pasturing is £ 6 0*s*. 5*d*.

1167 – **A Metayer's Family in Chianti (Tuscany).** — TASSINARI, G., in *Atti della Reale Accademia Economico-Agraria dei Georgofiii di Firenze*, Series 5, Vol. XI, No. 4, pp. 283-310. Florence, October 1914.

In order to enable comparisons to be made v ith other monographs on this subject, the data in this mcnograph have been arranged according to the plan elaborated by LE PLAY. The metayer's family which is the subject of this study represents with fair approximation the average type of farmer in the Chianti district from the point of view of eccnomic condition and moral and intellectual characteristics.

The holding is on hilly land and it comprises about 17 acres of arable land, with vineyard and fruit trees containing about 3 500 vines, 207 olives, 30 fruit and other trees, and 87 acres of woodland and rather steep pasture.

The area under herbaceous crops comprises about 7 to 10 acres of wheat (10 acres being the maximum), 2 ½ acres under forage and 4 ½ acres under the first crop after deep cultivation, which may include maize, beans, potatoes, tomatoes, etc; broad beans, chick peas and lentils are also grown.

Sainfoin and a little lucerne are grown as forage crops, and barley, oats, vetches, beans, etc., are sometimes grown for the same purpose.

The manure used is chiefly dung, particularly from sheep; chemical manures are rarely employed.

The farm products (those from the woodland being excepted) and the profits on the live stock are shared equally with the landlord, who provides half the cost of the seeds required and pays the estate taxes. The taxes on live stock are shared by the tenant and landlord. The house, garden and fire-wood are regarded as free allowances to the tenant, and the landlord is charged with the cost of fungicides. The annual charges of the tenant are about 400 ft of trenches for vines, etc., and 10 head of poultry.

The family includes 6 persons: 4 men and 2 women. The live stock belonging to the farm includes: 2 oxen, 1 sow, 4 pigs, 37 sheep and 6 lambs, valued at £ 100; the dead stock leased includes forage, litter and manure valued at £ 43, implements valud at £ 12, wine vats and materials for other industries valued at £ 6: the total, including poultry, reaching about £ 145.

The furniture, utensils, linen and clothing of the family are estimated at about £ 68.

The family balance sheet is summarised as follows:

	£	*s*	*d*
Farm products, farmer's half-share	78	7	8
Other profits allowed in the contract.	15	3	10
Total Receipts . . .	93	11	6
Expenses for permanent and temporary work, seeds, implements, machines, etc.	20	9	3
Net Profit . . .	£ 73	2	3

The total family expenses consume £67 4*s* 2*d* per annum, leaving £5 18*s* more or less, which goes to increase the credit of the metayer with his landlord.

This corresponds to a share of annual earning of £18 14*s* 11*d* per worker and of £13 8*s* 10*d* per consumer of the family (1).

AGRICULTURAL INDUSTRIES.

INDUSTRIES DEPENDING ON PLANT PRODUCTS

1168 – **The Origin, Quantity and Signification of Lactic Acid in certain Italian Wines.** — Mensio, C., and Garino Canina, E., in *Le Stazioni Sperimentali Agrarie Italiane*, Vol. XLVII, Part 6, pp. 385-409. Modena, 1914.

An attempt has been made to determine the quantity of lactic acid usually formed in some of the finest Piedmont wines as compared with the quantity in common wines; what are the conditions under which such formation takes place; what are the micro-organisms producing it; and what is its biological significance.

(1) This year's expenses have been increased owing to the military service of one of the sons, so that £15 figures in the account as outside labour.

The main results of the investigations are as follows:

1). Lactic acid is a constituent of all wines and may be present to the extent of 4 to 5 gms. per litre.

2). The amount increases gradually as the wine ages and though advantageous at first it may become distinctly injurious. In the case of many wines, *e. g.* Barolo, Barbaresco, Gattinara, malo-lactic fermentation is essential for the development of their organoleptic qualities. It is also of great importance for ordinary wines, especially those with a low percentage of alcohol.

3). This fermentation is due chiefly to micro-organisms analogous in shape and behaviour to *Bacterium gracile* of MÜLLER-THURGAU, which splits malic acid into lactic and carbonic acids but has no action on tartaric acid.

4) Malo-lactic fermentation causes a considerable decrease in the acidity of the wine.

5). "Turned" wines (containing decomposition products of tartaric acid and extractives which give rise to a disagreeable flavour and loss of the wine) are fortunately rare in Piedmont.

6) In testing wine for its origin, whether genuine or artificial, the determination of the lactic acid should never be neglected.

From a practical point of view it is important to remember that wine after a certain age should be considered as the product of two fermentations: the first and most important being the alcoholic fermentation and the second the malo-lactic fermentation. Wine makers should watch their wines with a view to increasing, preventing or retarding the decomposition of the acids according as it is desirable. The acidity may be diminished by retarding the racking, maintaining the cellar at a suitably high temperature, and avoiding the use of sulphurous compounds. The decomposition of the acids may be retarded by using sulphurous acid while making the wine, maintaining the cellar at a low temperature, and by the prudent repetition of the sulphurous acid treatment.

1169 – **Spanish Wines.** — DE LA ROSA, G. FERNANDEZ, in *Boletin de Agricultura técnica y economica*, Year VI, No. 67, pp. 622-626. Madrid, July 31, 1914.

According to the most recent statistics the area of vineyards in Spain is 3 396 460 acres, of which 1 891 160 are free from phylloxera, 1 047 420 have been reconstituted and 457 880 are infected and decadent, but still productive.

The methods of cultivation are, in many districts, antiquated and empirical. Propagation is by cuttings planted in holes and cultivation generally consists in ploughing, with hand-hoeing round each plant. Pruning is done annually and all the grapes are picked at once. In the best vine-growing districts, such as Jerez de la Frontera, Puerto de Santa Maria and Sanlúcar de Barranceda in the province of Cadiz, and several districts of the provinces of Malaga and Cordova, very different systems are practised. Before planting the vineyard the land is deeply trenched and thoroughly hoed over several times to aerate the soil; pruning, removing the surplus shoots and gathering the grapes are done at several times.

The best Spanish wines are the "finos" and "olorosos" of Jerez, "manzanilla" of Sanlúcar, muscatel of Malaga, "Pedro Ximenez" of Montilla, "pajarete" of Bornos, "tintilla" of Rota, "Cariñena" of Aragon (white wines); the wines of Alicante, Valdepeñas, Mudela and Calzada de Calatrava in the Mancha; those of "Priorato" in Catalonia; of Navarre and Rioja (red and rose-coloured wines).

The average annual production of grapes is 2 905 537 tons, of which 274 074 tons are used for direct consumption, and 2 631 464 tons are used for wine-making, producing 3 883 000 gals. of must. The average price has been 6*s* 2*d* per cwt. of grapes and 7.89 *d* per gallon of new wine. The average annual value of the wine products amounts to £14 454 138, not including £530 063 for lees and vinasse. It should be pointed out that this value would be considerably increased if it were based on the value of the mature wine instead of on the must and on new wine only a few months old.

Notwithstanding serious difficulties, the cultivation of the vine and wine-making in Spain are always improving, chiefly through the influence of educational centres, among which should be mentioned the Oenological Stations of Haro (Logroño), Villafranca del Panades (Barcelona) and Reus (Taragon).

1170 – **The Wines of Istria.** — BUFALINI, D., in *Giornale Vinicolo Italiano*, Year 40, No. 37, pp. 865-867. Casale Monferrato, September 13, 1914.

Agricultural conditions in Istria are little known to the outside world. During the last 10 years very rapid progress in the wine industry has been made, and this still continues. Istria may be divided into the following six wine-growing districts:

1. The Karst with the district of Castelnuovo.
2. The eastern coast with the districts of Albona and Volosca.
3. The southern coast with the districts of Pola, Dignano, Rovigno and Parenzo.
4. The northern and north-western coast with Tirano and Capodistria.
5. The mountain region and high plateau of the interior with Pisino and Pinguente.
6. The islands of the Quarnero: Cherso, Lussin and Veglia.

In a good year the total yeld of wine in Istria reaches 13 200 000 gallons, of which nearly half is exported.

The local wines are as follows:

1. "Vino terrano" or "refoteo" from white lands, characterised by a deep red colour and pronounced acidity.
2. White wine without special character, made from grapes which also yield a considerable product: Isolana, Durania, Malvasia, Dinella, Treolina, Tebbiano, Drasanella.
3. "Vino rosato", rich in alcohol and with limited acidity, rose coloured with an agreeable flavour, obtained from grapes which always yield well: Rossara, Planiva, Negra tenera, Bontempa, Moretta, Pignoletta, Crenatizza.

4. White muscat made from the grapes of the same name, especially in the districts of Buie, Momiano, Verteneglío.

5. The rose muscat wines of Dignano.

6. Sweet and sparkling " Refoschi " wines.

The foreign varieties grown successfully on American stocks are: Traminer, Pinot, Malvasia, Rhenish Riesling, Semillon, Burgundy (large bunched variety), Cabernet, Chasselas, Früher von der Lahn.

The control of phylloxera by replacing the vineyards with American stocks has enabled the introduction of foreign stocks which improved the local varieties. The production of large quantities of wine of uniform quality, which formerly presented such difficulties, is now an accomplished fact.

The provincial cellar of Parenzo produces about 110 000 gals., those of Brioni and Buie from 220 000 to 264 000 gals., the social cellars of Rovigno and Cittanova 11 000 gals. Vine-growing is the principal, though not the only, resource of the land in Istria.

1171 – **The Influence of Nitrogen Compounds on the Vulcanization of Rubber.** — — *The India Rubber World*, Vol. 4, No. 6, pp. 650-651. New York, September 1, 1914.

In the rubber industry it has not been until recently that the importance of small quantities of nitrogen compounds found in most rubbers has been recognized.

WEBER considered the protein contents of latex as " impurities " which may be eliminated by good coagulation.

Dr. DAVID SPENCE (*Journal of the Society of Chemical Industry*, 1907, p. 1287) investigated the distribution of protein in rubber and found that in the insoluble part there was sometimes as much as 5.4 per cent of nitrogen ; this would mean about 33 per cent protein.

SCHIDROWITZ in 1911 noted that plantation rubber is usually deficient in nitrogen.

At the Eighth International Congress of Applied Chemistry held in New York in 1912, CLAYTON BEADLE and H. P. STEVENS described an investigation of *Hevea* latex. They found that the latices contained from 1.31 to 1.56 per cent protein ; that the percentage of protein of the total solids varied from 5.1 to 5.5, and that about one half of this protein was retained in the washed and coagulated rubber in the form of dry crêpe. The same STEVENS in the *Colloid Zeitschrift* (Vol. XV, Nos. 1 and 2, pp. 36-49 and 86-96, Dresden and Leipzig, July, August, 1914), showed that the nitrogenous constituents had much influence, and the resinous constituents little influence on vulcanization.

CLAYTON BEADLE and H. P. STEVENS separated the protein matter which contained the nitrogen, from smoked sheet. (1) Then they vulcanized the nitrogenous part and the nitrogen-free part and the original sheet. It was found that the part of the rubber with high nitrogen contents vulcanized more rapidly and combined with more sulphur than the

(1) See No. 131, *B.* Feb. 1913. (*Ed.*)

original sheet and that the nitrogen-free part combined with the least. The strength and resiliency of the nitrogen-containing part was the greatest.

The question then arises whether nitrogenous compounds may be added to rubber to act as hasteners of vulcanization or to give improved products.

In the *Gummi Zeitung* (Year 28, No. 19, p. 731, Berlin, February 1914) it is shown that albumen added to rubber increases the speed of vulcanization.

In the French patent No. 466 243, scrap rubber is heated with caustic soda and a small quantity of an aromatic amino compound, which acts as a catalyst to unite the free and combined sulphur with the alkali. In a German and English patent piperidine or its homologues are added to the vulcanizing masses ; in another patent piperidine or its homologues are used for producing hard rubber by adding 25 per cent sulphur.

In other patents the following substances are used : the derivatives or salts of piperidine, aliphatic amines with open or closed chains, the addition product of carbon disulphide and dimethylamine, aniline, naphthyl amine, a paste of albumen and lime.

Almost all the above-mentioned agents are organic nitrogen compounds, usually in the form of amines, and this authorizes the conclusion that this form of nitrogen has some catalytic influence in hastening the combination of rubber and sulphur, and in polymerizing the rubber itself.

With the use of large quantities of plantation rubbers which are known to be deficient in both proteins and other nitrogen compounds, and which are recognized as being much slower in vulcanization than Para, it would seem to be desirable to determine on some substance, like the above, which will act as a hastener.

INDUSTRIES DEPENDING ON ANIMAL PRODUCTS

1072 – **The Cause of Acidity in Fresh Milk of Cows and a Method for the Determination of Acidity.** — VAN SLYKE, L. L., and BOSWORTH, A. W. (New York Agricultural Experiment Station) in *The Journal of Biological Chemistry*, Vol. XIX, No. 1, pp. 73-76. Baltimore, Md., September 1914.

The fact that milk is strongly alkaline to methyl orange would indicate that its acidity is due to the presence of acid phosphates of the type MH_2PO_4. Now when phosphates are titrated with alkali in the presence of calcium salts, some of the insoluble dicalcium phosphate ($CaHPO_4$) formed during the titration hydrolyses, changing into calcium hydroxide and phosphoric acid, and then the calcium hydroxide unites with more dicalcium phosphate to form tricalcium phosphate, which appears as a precipitate. These conditions occur when the acidity of milk is determined in the usual methods with $\frac{N}{10}$ caustic soda, and the free phosphoric acid formed increases the acidity as measured by titration.

Serum was separated from whole milk by filtration through a porous porcelain filter and the titration figure given by whole milk was about twice that obtained with the serum. This difference has been ordinarily interpreted as being due to the acidity of milk casein, but as the writers have some evidence that casein is present in milk in the form of a neutral com-

pound and the other constituents removed by the filter are fat and dicalcium phosphate, both of which are neutral to phenolphthalein, it would appear that the cause of the discrepancy is the removal of the dicalcium phosphate which permits the formation of phosphoric acid.

The writers therefore suggest that in estimating the acidity of milk samples, the calcium should be previously removed by treatment with a saturated solution of neutral potassium oxalate at the rate of 2 cc. per 100 cc. of milk.

1173 - **Ability of Streptococci to Survive Pasteurization.** — AYERS, S. HENRY, (Bacteriologist) and JOHNSON, WILLIAM T., Jr. (Scientific Assistant, Dairy Division, Bureau of Animal Industry) in *Journal of Agricultural Research*, Vol. II, No. 4, pp. 321-330 + 3 diagr. Department of Agriculture, Washington, July 1914.

It is generally assumed that cocci do not form spores and the vegetative cells would not be expected to withstand Pasteurization. It has been shown, however, by the writer and others, that certain strains of lactic-acid bacteria, which would be classified among the streptococci, and perhaps some streptococci found in cream, are able to survive Pasteurization.

The writers have resumed the experimental study of the question and they summarize the results obtained as follows:

1. When the heating was performed in milk for 30 minutes under conditions similar to Pasteurization the thermal death-points of 139 cultures of streptoccci isolated from cow feces, from the udder and the mouth of the cow, and from milk and cream, showed a wide variation. At 60° C. (140° F.) the lowest Pasteurizing temperature, 89 cultures, or 64.0 per cent, survived; at 62.8°C. (145° F.), the usual temperature for Pasteurizing, 46, or 33.1 per cent, survived; and at 71.1° C. (160° F.) 2.6 per cent of the cultures survived; all were destroyed at 73.9° C. (165° F.).

2. The streptococci from the udder were, on the whole, less resistant and those from milk and cream more resistant to heat than those from the mouth of the cow and from cow feces. When heated to 60° C. all of the 18 cultures from milk and cream survived; at 62.8° C. 17, or 94 per cent, survived; at 68.3°C. (135°F.) 9 cultures, or 50 per cent, withstood the heating process. All the streptococci from milk and cream were destroyed by heating to 73.9°C. for 30 minutes.

3. Among the 139 cultures of streptococci there were 22 that formed long chains and were considered (following the practice of some board of health laboratories) as typical streptococci The others were considered atypical. (The writers, however, do not believe the chain formation a proper basis for classification). Of the 22 typical streptococci, 12 survived heating for 30 minutes at 57.2°C. (135°F.), 9 at 60°C. and only 1 at 62.8° C. All of the typical streptococci were destroyed at 65.6° C. (150°F.).

The 117 atypical streptococci were more resistant; at 60° C. 68.4 per cent survived, at 62.8° C. 38.5 per cent survived, and at 71.1° C. 2.5 per cent survived; all were destroyed at 73.9° C.

4. Two classes of streptococci seem to survive Pasteurization:

a) Those which have a low majority thermal death point but among which a few cells are able to survive the Pasteurizing temperature. This

ability of a few bacteria to withstand the Pasteurization temperaturs may be due to certain resistant characteristics peculiar to a few cells, or may be due to some protective influence in the milk.

b) Streptococci which have a high majority thermal death point. When such is the case the bacteria survive because the majority thermal death point is above the temperature used in Pasteurization. This ability to resist destruction by heating is a permanent characteristic of certain strains of streptococci.

5. The thermal death point determinations in this work were made in milk in such a manner as to represent actual conditions of Pasteurization by the holder process ; consequently the results show what may be expected in commercial Pasteurization, and it is evident that some streptococci may survive the process. However, different results might have been obtained if a larger number of cultures had been studied and if other methods and media had been used for determining the thermal death points.

1174 – **Action of Bacteria on the Ripening and Flavour of Cheese of the Cheddar Type.** — I. – EVANS, ALICE C. (Bacteriologist, Dairy Division, Bureau of Animal Industry), HASTINGS, E. G. (Bacteriologist, Wisconsin Agricultural Experiment Station) and HART, E. B. (Chemist, Wisconsin Agricultural Experiment Station). Bacteria Concerned in the Production of the Characteristic Flavour in Cheese of the Cheddar Type.. — *Journal of Agricultural Research*, Vol. II, No. 3, pp. 167-192. Washington, June 15, 1914. — II. – HART, E. B., HASTINGS, E. G., FLINT, E. M. (Chemist, Dairy Division, Bureau of Animal Industry) and EVANS, ALICE C. Relation of the Action of Certain Bacteria to the Ripening of Cheese of the Cheddar Type. — *Ibid.*, pp. 193-216.

I. — This is a continuation of previous investigations (1) consisting 1) in many bacteriological analyses of cheeses in order to determine more fully the distribution of the groups of bacteria in ripening cheese; 2) in a detailed study of the pure cultures obtained, with the view of correlating the presence of certain types with desirable or undesirable flavour production.

In the previous work the pure cultures were obtained by isolation from lactose-agar plate cultures and from dilution cultures in sterile milk. In the present study the dilution cultures were made in milk to which was added 1 gram of peptone, 1 gram of dextrose and 200 cc. of water per litre. This was found to be more favourable for the development of some of the cheese organisms. An effort was made to obtain two pure cultures from each series of dilution cultures : *viz.* the predominating organism of the *Bacterium lactis acidi* and coccus groups, and the predominating organism of the *B. casei* group. The former was obtained by plating — in casein agar to which 1 per cent. of dextrose was added — the culture from the highest dilution of the cheese which shows a growth after two days incubation; the latter was obtained after three weeks' incubation. On every plate a portion containing 10 colonies was circumscribed, and the inclosed colonies were fished off into litmus milk.

(1) See No. 868, *B.* July 1913. (*Ed.*)

Those cultures from a single plate which caused the same changes in litmus milk and were of the same morphology, were considered of the same variety. Representatives of every variety were studied in detail. This method, which allows the examination of a large number of cheeses and gives a rough picture of their flora, was considered the best adapted to increase present knowledge on the subject.

The cultural characteristics, morphology, and the few biochemical reactions which are ordinarily considered in classification of bacteria, were found to be inadequate for distinguishing one variety of cheese organism from another of the same group. Therefore the system of classification based upon the fermentation of various test substances, used by Gordon and others, was adopted.

The results obtained by the writers are summarized as follows: The organisms constantly found in Cheddar cheese in such numbers as to indicate that they must function in the ripening process are included in four groups: *Bacterium lactis acidi*, *B. casei*, *Streptococcus* and *Micrococcus*. On the basis of the fermentation powers, each of the four groups may be divided into a number of varieties, the distribution of which in Cheddar cheese, prepared from both raw and pasteurized milk, has been studied. The flora of raw-milk cheese includes all the varieties into which the groups were divided. The flora of pasteurized milk cheese, with the exception of the *Bacterium casei* group, is dependent upon the flora of the starter. It seems that the pungent taste that develops late in the ripening period of both raw-milk and pasteurized milk cheeses is due to the *Bacterium casei* group. It is probable that growth of this group continues during the major part of the ripening period. The action of two or more organisms growing together is not the sum of their individual actions when growing alone. When growing together they may attack substances that neither can attack alone, or they may produce a larger quantity of acid than the sum of the quantities that either can produce alone. When added to pasteurized milk, the organisms of the *Bacterium casei* group produce a sour taste in the cheese during the early part of the ripening period. No Cheddar flavour is obtained in pasteurized-milk cheese when the organisms of the *Bacterium lactis acidi* group alone are used as starters. The varieties that are able to ferment the more complex substance are likely to produce a bitter taste.

Starters composed of both *Bacterium lactis acidi*, *b*, and *Streptococcus*, *b*, when added to pasteurized milk, improve the quality of the cheese. It does not seem unreasonable to hope that starters may be obtained that will give the characteristic Cheddar flevour to the cheese prepared from pasteurized milk.

II. — In a preliminary investigation of the non-nitrogenous constituents of Cheddar cheese, the very pronounced differences that were expected in the quantity and variety of volatile acids, esters and alcohols in good and poor types of cheese were not found. But since there were certain differences which could be only of biological origin, it was believed essential that the substances formed by the specific groups of organisms normally present in cheese should be more carefully studied. It was thus hoped to find

the groups of organisms to which the production of definite non-nitrogenous compounds that could be correlated with flavour production might be attributed. The compounds particularly sought were the alcohols and esters, and caproic and butyric acids. Formic, acetic, propionic, lactic and succinic acids were also included in the list of substances to be isolated. To some extent the sources of these bodies were also studied.

The writers summarize as follows the results of their very numerous and detailed experiments:

1. Representatives of the coccus groups of organisms isolated from Cheddar cheese, when grown in milk, produced large quantities of the volatile acids, particularly acetic acid. These acids were produced from citric acid or lactose or protein, as the medium was practically free from fat. These organisms did not produce formic acid. As they are present at times in very large numbers in cheese, they no doubt produce much of the volatile fatty acids which arise during the ripening process.

2. One of the strains of *Streptococcus b* was found to produce comparatively large quantities of alcohols and esters — bodies which contribute in a large degree to the flavour of cheese.

3. A dilute solution of acetic acid and alcohol formed esters by mere contact, without bacterial action.

In cheese, however, the dilution is probably too great for this manner of ester formation.

4. Lactic acid was generally not formed by the coccus groups.

5. The representatives of the *Bacterium casei* group examined, gave results differing from those obtained from the coccus forms. They produced no formic acid, but did form some propionic and much acetic acid.

6. These organisms produced a large quantity of lactic acid, both active and racemic, and decomposed the citric acid of the media.

7. Cheese made from chloroformed fresh milk did not yield any volatile fatty acids, showing that inherent milk enzymes are not capable of producing these bodies in any appreciable quantity.

8. Representatives of both the coccus and *Bacterium casei* groups were able to produce ammonia from milk.

9. Whey and fresh curds contained active lactic acid. Cheese one day old contained a mixture of active and racemic lactic acids.

10. The cause of the disappearance of active lactic acid and the appearance of racemic acid may be due to enzymic action, combined with the action of those bacteria which can produce both kinds of acid.

11. Some representatives of the *Bacterium casei* group produced levo-lactic acid and others dextro-lactic acid from milk. A mixture of these two varieties produced racemic lactic acid. A mixture of *B. lactis acidi* and a levo-producing member of the *B. casei* group gave racemic and active lactic acid. The active acid was probably the result of the longer continued activity of *B. casei*.

12. Racemic lactic acid found in curing cheese may therefore be produced in a small degree by enzyme action, but more probably by

the combined action of *Bacterium lactis acidi* and the organisms of the *B. casei* group.

1175 – **The Part Played by Micro-organisms in the Ripening and in the Production of the Pungent Flavour of Brindza, the Ewes' Milk Cheese made in Hungary.** — GRATZ, O., and VAS, K. (Experimental Dairy at Magyaróvár). — I. The part played by micro-organisms in the ripening and in the production of the pungent flavour of Brindza. — *Kiserletügyi Közlemények*, Vol. XVII, Part 3, pp. 347-394. Budapest, May-June, 1914. — II. On some new species of micro-organisms found in Bridza. — *Ibidem*, Vol. XVII, Part 4, pp. 635-644. Budapest, July-August 1914.

I. — The making of Brindza cheese differs essentially from that of other cheeses in that it is formed by kneading together several balls of curd prepared in different ways in different localities and under different conditions (1). The kneading, which is chiefly carried out in factories, undoubtedly causes a transformation of the bacterial flora and of the conditions of the enzymes in the paste of the balls. The objects of the present study are : 1) to determine the bacterial flora of Brindza and its qualitative and quantitative changes during the ripening of the stored cheese ; 2) to identify the organisms which produce the pungent flavour in Brindza and to explain its presence ; 3) to draw useful conclusions from the results obtained so as to improve the methods of making this cheese.

The experiments were made with five samples of fresh Brindza (some weeks old), which were subjected to control lasting six months. The bacteriological analyses were made at intervals of from 4 to 6 weeks.

The writers drew from their research the following conclusions :

1. The bacterial flora of Brindza is very varied. It includes *Micrococcus*, *Sarcina*, *Streptococcus*, *Bacterium*, *Bacillus*, *Actinomyces*, *Torula*, *Oidium*. Among the species isolated, there are several which have not hitherto been described in the literature on the subject. This great variety of microflora is to be attributed not only to the want of cleanness of the ewe's milk and to the bad rennet (made with water and easily liable to putrefaction), but also to contamination, during the making, due to the crust of the balls, the salt, the machines and implements.

2. Brindza is very rich in micro-organisms. There is no cheese with so high a germ content as Brindza, notwithstanding the fact that after it is made and during storage the multiplication of micro-organisms ceases. Most of these are lactic bacteria, especially *Bacterium casei*, *Streptococcus lactis*, *Micrococcus* ; nevertheless, though very numerous (61 per cent), they do not attain the proportion that they reach in other cheeses (79 to 95 per cent). The cause of this is in the difference of manipulation, as compared with other cheeses, which introduces a large number of accidental germs and thus reduces the number of lactic bacteria.

3. The accidental micro-organisms, the presence of which is very inconstant, disappear soonest. Quantitative analyses have shown that during storage the content of germs in Brindza diminishes. At first the decrease is very marked, while later it slackens. Streptococci and cocci die much

(1) See No. 1669, *B.* Dec. 1912. (*Ed.*)

sooner than lactic bacilli, which are found together with their spores even in very strong Brindza.

4. Research has shown that the accidental micro-organisms do not take part in the ripening of the cheese, because its conditions do not favour either their development or the activity of their enzymes. The agents which cause ripening are therefore the lactic bacteria ; nevertheless the enzymes of the rind of the curd balls also play an important part in the ripening of Brindza.

5. Results have demonstrated that the origin of the piquant flavour of some ewes' milk cheeses is due only in exceptional cases to butyric fermentation, and generally to a great decomposition of the fatty matter. This decomposition is not caused by the bacteria having the power of attacking fatty matter ; this is proved by the fact that they have often been found in greater numbers in sweet Brindza than in strong pungent Brindza.

6. The agents of the great decomposition of fatty matter are enzymes and in the first place the lipase of *Oïdium lactis*. The result is that if the outside of the curd balls (rich in butyric ferments and on which *Oïdium lactis* is always present) and the fat layer under this outside (in which the enzymes are found) are not carefully removed when the cheese is worked up again, as is often the case, the above parts come into contact with the whole of the kneaded paste and communicate a pungent flavour to the cheese.

7. Observations made during the process of ripening have shown that strongly flavoured Brindza has a pale orange colour ; it is dry, subject to crumbling, strongly smelling and never turns mouldy. On the other hand sweet Brindza has generally a normal consistence, but it becomes sticky and mouldy if it is not kept hermetically closed.

As for the practice of the manufacture of Brindza, the results of observations may be summarized as follows. It is not essentially necessary that Brindza should have a pungent flavour, because the origin of this flavour is not due to the action of micro-organisms the presence of which could not be avoided by the cheese-maker, but to the manipulation allowing the lipolytic enzymes existing on the rind of the balls to exert their influence, which fact had not hitherto been recognized. Knowing the factors which give Brindza this special taste, the cheese-makers will be able to modify it by adopting a suitable process of manufacture (careful removal of the rind of the balls).

The paper contains bibliographical notes, as well as diagrams and tables showing numerical results of the analyses made.

II. — Description of some new species of micro-organisms found during the research on the flora of Brindza and the part they play in the ripening and production of the special flavour of this cheese. Considering the various properties of these bacteria observed during their culture, and their biochemical action, they do not resemble any of the micro-organisms known so far to the literature of bacteriology. These new species are: *Bacterium saponificans, Bact. adipis, Bact. rufum, Bacillus gravidus, Bac. submergens, Bac. exilis, Bac. cerasinus, Bac. parabutyricus, Bac. indolicus.*

1176 – **The Phosphorus Content of Casein.** — BOSWORTH, A. W., and VAN SLYKE, L. L. (New York Agricultural Experiment Station) in *The Journal of Biological Chemistry*, Vol. XIX, No. 1, pp. 67-71. Baltimore, Md., September 1914.

The amount of phosphorus in casein has been commonly given as about 0.85 per cent. By treating a solution of casein in excess of dilute ammonia with ammonium oxalate and letting it stand twelve hours, the phosphorus content is reduced to 0.71 per cent. This lower percentage cannot be explained as being due to hydrolysis of casein and splitting of phosphorus, for though some of the casein is hydrolised, the hydrolised portion does not enter into the final preparation or affect its composition. The higher figure ordinarily given is due to the presence of inorganic phosphorus (dicalcium phosphate) carried from the milk into the precipitated casein and not entirely removed under the usual conditions of preparation. The lower figure corresponds very closely to two atoms of phosphorus in the casein molecule. Analyses of various preparations of casein containing varying amounts of ash show a general correspondence between the ash and phosphorus content.

1177 – **A Comparison between the Fat Stock and the Carcasses Exhibited at the Smithfield Show, 1913.** — LONG, JAMES, in *The Journal of the Board of Agriculture*, Vol. XXI, No. 1, pp. 1-12. London, April 1914.

The Smithfield Club holds each December a show of pure and cross-bred fat cattle, sheep and pigs. In 1896 a new section was added to the Smithfield show, for the best carcasses of beef and mutton, and this competition has continued ever since. In 1903 classes for pigs were added to the carcass section.

In the last competition the judges showed a decided preference not only for lean meet but also for small meat, and this applies to the carcasses of cattle and sheep as well as to pigs.

From the difference between the live-weight and the carcass-weight it appears that the younger the animal matures and can be finished for slaughter, the smaller will be the cost of producing a pound of meat, the better its quality and the smaller the waste.

In the 1896 carcass competition the two-year-old steers averaged 1323 lb. live-weight and 864 lb. in the carcass, or 65 per cent.

The average live-weight of steers under two years old is 1363 lb. Omitting the Highland cattle, the average weight in the class from 2 to 3 years is 1772 lb., which exceeds the former by 409 lb., or an estimated difference in the carcass-weight of 266 lb. This shows that it cannot pay the feeder to keep a steer for the additional year, since the actual weight of beef produced barely exceeds 5 lb. a week. The estimated carcass-weight of the steers under two years old is 886 lb., or 80 lb. more than that of the prize steers in the carcass class, while for steers between two and three years old, this estimated average is 1136 lb., or 282 lb. more than the actual average carcass-weight of the whole class. This difference represents much additional fat, that is, a factor which depreciates the unit of weight of the meat.

In the classes for heifers similar results are obtained. The average live-weight of the older animals is only 1576 lb., against an average of 1322 for the younger ones, showing an increase for one year of only 254 lb., which is reduced to 165 lb. of carcass. It is evident that this cannot pay. The accompanying tables show the weights observed:

TABLE I. — *Average live-weights of pigs exhibited in* 1913.

Breed	Under 9 months		9 to 12 months	
	Live-weight	Estimated weight of carcass	Live-weight	Estimated weight of carcass
	lb.	lb.	lb.	lb.
Berkshires	335	268	400	320
Tamworths	314	250	476	380
Lincolns	402	321	469	376
Large Whites	383	306	490	392
Middle Whites	302	241	400	320
Large Blacks	396	316	508	406

TABLE II. — *Average live and carcass weights of sheep exhibited in* 1913.

Breed	Open classes	
	Live-weight	Estimated carcass-weight
	lb.	lb.
Long-wool lambs	172	94
» wethers	248	142
Short-wool lambs	177	99
» » wethers	244	146
» » crosses, lambs	187	108
» » » wethers	172	99
Cheviot and Mountain	299	180
1st cross lambs	164	90
» » wethers	239	136
Cheviot lambs	152	83
» wethers	237	136
Suffolk lambs	200	112
» wethers	239	143
Southdown lambs	137	78
» wethers	191	108

Prize lots	Carcass Classes	
	Live-weight	Actual carcass weight
	lb.	lb.
Long-wool lambs, all Cheviots	115	63
» wethers, all Cheviots	138	79
Short-wool lambs, Southdowns	95	54
» » Suffolks	134	75
» wethers, Southdowns	122	69
Other short-wools, wethers	160	98
Cross-bred lambs	120	58
» » wethers	164	98

TABLE III. — *Average live and carcass weights of steers and heifers, exhibited in* 1913.

Breed	Open classes			
	Under two years		From two to three years old	
	Average live-weight	Estimated carcass-weight	Average live-weight	Estimated carcass-weight
	lb.	lb.	lb.	lb.
Steers.				
Devons	1 290	839	1 803	1 172
Herefords	1 419	922	1 978	1 286
Shorthorns	1 483	964	1 873	1 217
Sussex	1 356	881	1 826	1 187
Red Polled	1 320	858	1 492	970
Aberdeens	1 352	879	1 760	1 144
Galloways	1 231	800	1 672	1 087
Welsh	1 391	904	1 722	1 119
Crossbred (1st cross)	1 421	924	1 925	1 251
» (2nd and 3rd cross)	1 368	889	1 667	1 084
Heifers.				
Devons	1 351	878	1 598	1 039
Herefords	1 298	844	1 556	1 011
Shorthorns	1 336	868	1 606	1 044
Sussex	1 372	892	—	—
Aberdeens	1 249	812	1 627	1 058
Crossbred (1st cross)	1 269	825	1 709	1 111
» (2nd and 3rd cross)	1 383	899	1 642	1 067

Carcass class	Average live-weight	Actual carcass-weight
	lb.	lb.
Prize steers under two years	1 226	806
» » from two to three yaars old (the whole class)	1 330	854
» heif rs under two years (eight animals including the winners)	1 146	747
Prize heifers from two to three years (Shorthorn-Aberdeen)	1 382	924

1178 – **"Quality" in Wool.** — BAILEY, P. L., and ENGLEDOW, F. L., in *The Journal of Agricultural Science*, Vol. VI, Part 3 pp. 349-370. Cambridge, September 29, 1914.

NATHUSIUS, BOHM, KONIGSBOM, BOWMAN, MC MUTRIE and others have shown that "quality" in wool depends upon several factors, including

1) Fineness of fibre as measured by the average diameter.
2) Number of crimps or waves per unit length of the fibre.
3) Length.
4) Lustre.

The writers of this paper determined to repeat the work of the above writers and to subject the results to a statistical analysis. They studied the fleeces of crosses of Shropshire ewes with Australian Merino rams. They examined over 700 microscopic slides and made about 30 000 measurements. The present paper deals in particular with the relation between "fineness of fibre" and the commercial grading of the wool.

At shearing, samples were taken from both of the shoulders, the neck, the britch and the belly. A skilled Bradford sorter divided this wool into eight classes indicated by numbers 64's to 40's, which are based on the spinning capacity of a given weight of wool.

For the microscopic investigation, four sub-samples, A, B, C, D, were taken from each sample; from each sub-sample three portions were cut off, one at the tip end (T_1), another from the middle (T_2) and a third from the base (T_3). Each portion was placed on a glass slide and fixed with balsam. The measurements were made with a micrometer eye-piece, each division of the scale representing $\frac{1}{8000}$ of an inch. The figures in this paper are, unless otherwise stated, based upon a unit of measurement equal to one eye-piece-scale division.

The results and conclusions may be summarized as follows:

1. The method of taking four sub-samples and making in all 160 measurements of them gives a satisfactory value for the average diameter of the sample. The amplitude of the variation of the probable errors is given by the range 0.064—0.154 or, as percentages of the averages concerned, 1 to 1.6 per cent. Thus, if the largest magnitude of the probable error be taken, the odds are 20 to 1 that the average of 160 measurements is correct to within 5 per cent.

2. The average of the samples from each shoulder gives a good indication of the shoulder for each sheep. From a study of four cases showing exceptional fluctuation in the averages of the sub-samples it appeared that the probable error was 0.263 units, or a little over 3 per cent of the average. Consequently, even in cases of the greatest variability, one can rely upon the average obtained from the sub-samples representing the whole shoulder average to within 10 per cent. In the great majority of cases it will be correct to within 5 per cent.

3. In comparing two sheep, A and B, we may take as almost certainly significant a difference between their two average shoulder diameters such that the ratio

$$\frac{M_A - M_B}{\varepsilon_{AB}} > 3,$$

that is a difference of some 8 per cent of the average shoulder diameter of either of them for measurements taken as here indicated. In other words, if the averages of the shoulder samples of two sheep differ by more than three times the standard error (1) of their difference, one may be satisfied that this difference is real and not due to any small variations in the position on the individual sheep from which the shoulder sample was taken.

4. A relationship exists between the fineness of the wool (as measured by the average diameter) and the commercial quality into which the wool is graded. But this relationship is not absolute. Thus, sheep that had suffered from a *Strongylus* attack, produced finer wool during the illness, so that the fibre presented a line of weakness with decrease of diameter. In such cases the average diameter is smaller and yet the commercial quality is inferior.

There is a correlation between the fineness of wool and the number of crimps per inch, but this appears to cease after the number has reached about 23 per inch.

5. The average diameter at the tip is the best guide from a genetic point of view as to the fineness of the wool concerned, owing to the marked pathological influences which may affect the base average.

6. The distribution of the fibres of different sizes has a modifying effect upon the commercial quality which would be assigned from a consideration of the average size only. It is suggested that the standard deviation of the distribution of the fibres should be used as a measure of this modifying effect.

In the accompanying table are given the " qualities ", the average diameter sizes (M) of the fibres in those qualities and the standard deviations (σ) of the distributions. An examination of the figures there given shows that in the case of T_1 there is a distinct parallelism between the quality assigned by the sorter to the sample and the standard deviation of that

(1) See C. B. DAVENPORT: *Statistical Methods*, 1904; also R. LOCK: *Recent Progress in the Study of Variation, Heredity, and Evolution*, London, 1911 (chapter on *Biometry*, pp. 80-120). (*Ed.*)

sample, a fall in " quality " being accompanied not only by a rise in the average diameter size, but also by a rise in the standard deviation. This latter rise cannot be explained as being wholly due to the rise in the average diameter, as is shown by the fact that there is also a rise in the coefficient of variation $\frac{\sigma}{M}$.

In order to study more closely the question of influence of variability of sample on the commercial quality, the percentage occurrence of diameters of every size was calculated for all the qualities. From the Table of the numerical results the qualities are seen to group themselves into four classes :

Class I : the 60's and 58's. The fibre distributions for these two qualities are much alike and show a comparatively small dispersion.

Class II : the 56's. The distribution for this class is of the same general nature as that of the preceding class, but shows a distinctly greater dispersion.

Class III : the 54's and 50's. The distribution appears to be bimodal, and the range of variability is much increased.

Class IV : the 44's. Fibres distributed in two or three modes and tending to coarseness.

The writers make some reserves on the generalization of their results, owing to the hybrid nature of the sheep from which the samples came.

Quality	T_1 Average Diam.		T_2 Average Diam.		T_3 Average Diam.		$\frac{T_1+T_2+T_3}{3}$	$\frac{T_1+T_3}{2}$
	M	σ	M	σ	M	σ	M	M
60's	8.11	1.47	8.11	1.52	5.41	1.25	7.21	6.76
58's	7.68	1.88	8.03	3.19	6.18	1.59	7.30	6.93
56's	8.28	1.92	8.28	1.84	7.16	1.70	7.91	7.72
54's	9.44	2.35	9.03	2.26	6.81	1.86	8.43	8.13
50's	8.93	2.19	8.83	2.21	6.92	2.45	8.23	7.93
44's	9.61	3.51	8.07	2.71	6.94	2.87	8.21	8.28
40's	8.36	2.11	8.18	2.37	6.18	1.92	7.57	7.52

1179 - **Libyan Hides and Skins.** — ndustrial Experiments on Sudanese and Libyan Hides and Skins (From a Report of the Director of the Royal Experiment Station of the Leather Industry at Naples) in *Ministero delle Colonie, Ufficio economico, Bollettino di Informazioni*, Year II, No. 7-8, pp. 531-535. Rome, July-August 1914.

The production of cattle in Tripolitania amounts annually to about 50 000 head. The animals are somewhat small, and weigh, on an average, 660 lbs. The salted and dry hides of adult animals received from Tripoli by the Royal Leather Experiment Station at Naples, weigh on an average 21 lbs.; the calf skins weigh 6 lbs., while those from Cyrenaica weigh respectively 15½ lbs. and 6½ lbs.

The hides from Cyrenaica were better than those from Tripolitania and more carefully sorted. In general, the products of both places were fairly good, being soft and of equal body and substance. They, however, had some easily eliminated defects (imperfect flaying and preservation, brand marks, etc.) and some were perforated by warbles.

Goat breeding is extensively practised in Tripolitania. The goats are of medium size, with black or reddish hair; their tails are small and little covered with hair. The height of the withers is from 2 ft. to 2 ft. 2 in. Beneath the hair is a wool which the natives weave into materials for local use. A goat weighs about 66-88 lbs. and the kids, which are sold when very young, weigh from 11 lbs. to 15 ½ lbs. During the four months July-October 1913, 63 417 lbs. of untanned goatskins were exported from Tripoli and neighbourhood. The goatskins received from Cyrenaica and Tripolitania by the Royal Experiment Station at Naples are well suited to working *à chevreaux*, according to the English system of *semi-chromo* (tanning with gambier and a basic solution of chromium), for the preparation of a special leather "Dongola" (tanned with alum and gambier), and for cheap Morocco (tanned with sumach, gambier and quebracho and dyed with anilin colours). The goatskins of Tripolitania and Cyrenaica have proved to be of good quality and sufficient substance, without too much waste.

About 100 000 sheep are exported from Tripolitania. These animals belong to three species. The Orfella thin-tailed breed, the fat-tailed Gebel sheep with short legs, and the large Sudan animal which is without wool. In Tripoli medium-sized fat-tailed sheep are very plentiful. Their fleeces would be thick and uniform if they were well kept; but frequent skin diseases cause a partial loss of wool. The average weight of the Tripoli sheep is about 84 lbs., that of the rams is 88 lbs., while lambs 4-6 months old weigh 40 lbs., and those over a year old attain a weight of from 62 to 66 lbs. During the four months July-October 1913 about 117 115 lbs. of lamb and sheep skins were exported from Tripoli. The sheepskins received by the Royal Experiment Station at Naples were tanned as follows: 1) with the wool, for carpet leather; 2) for glove skins, from which excellent goods were obtained.

Libyan camel skins are not very important articles, as they are only sold when the animals are killed because they are past work, or when they die a natural death. From July-October 1913 about 11 365 lbs. of camel skins were exported from Tripoli. They are very irregular in shape and very defective. When tanned, they fetch barely £1 8*s* 3*d* per cwt. The inferior skins can be used for second quality sole-leather; those tanned with chromium serve for making lacings and straps.

AGRICULTURAL PRODUCTS: PRESERVING, PACKING, TRANSPORT, TRADE

1180 – **Experiments on Storing Swedes during the Winter, in Denmark.** — 58. *Meddelelse fra Statens Forsøgsvirksomhed i Plantecultur. Ved. Statens Plantcavlsudvalg.* Copenhagen, October 2, 1914 (Communicated by the Danish Correspondent of the International Institute of Agriculture).

The experiments were carried out during the four winters from 1909 to 1913 in the farms belonging to the Experiment Stations of Studsgaard, Varde and Holstebro.

Similar experiments made in 1906 showed that when mangolds were kept in large broad pits covered with seaweed and in field clamps, the loss in dry matter during the winter was not so great as when they were kept in cellars. The experiments which have now terminated show that the same holds true for swedes.

With a crop of swedes containing 59 ¾ cwt. of dry matter per acre, the losses were 7 cwt. of dry matter when they were kept in large pits till the middle of March, 8 cwt. in field clamps, and upwards of 13 ½ cwt. when they were kept in cellars.

The loss with swedes is somewhat greater than with mangolds, and this is especially noticeable after the month of January. The cause of this lies in the fact that towards spring the loss caused by rot in the swede pits is much greater than in the mangold pits, and besides this, the direct loss of dry matter due to the vegetative activity of the roots seems to be greater in swedes than in mangolds.

In the choice between pits and clamps it must be borne in mind that the pits, besides causing a somewhat smaller loss during the winter, have also the advantage of being cheaper to cover and uncover than the clamps. On the other hand frost gets into pits more easily than into clamps ; when no heather, seaweed or other suitable material is easily available, then clamps are to be preferred to pits. The experiments have shown that the winter losses in clamps are smaller when the ends are covered at once and the top only in December, unless continued frost should render this necessary sooner. The sides of the clamps were covered with earth and the top with heather.

The higher the temperature in the pit, the greater was the loss during the winter ; the importance of attending to ventilation at once in the autumn in order to keep the temperature as low as possible in the pit, was proved. By a suitable arrangement of air passages in the bottom of the pit, the temperature was lowered during the first months by 1 to 2° C. (1.8 to 3.6° F.). The lower temperature diminishes the vegetative activity of the roots ; consequently the loss of dry matter between autumn and the middle of March was 1 ½ cwt. per acre less in ventilated than in unventilated pits and 1 cwt. per acre less in ventilated clamps than in unventilated ones. As the value of the dry matter can be estimated at 5 *s* per cwt., the cost of ventilation is negligible in comparison to the loss that would be caused by neglecting to ventilate the pits. From New Year's day onwards the air passages in the pits were closed, as they had been previously during periods of frost.

When the clamps are made in the second half of October, the temperature in them is higher than when they are made at the beginning of November. The experiments have shown a loss of 16 cwt. of dry matter per acre when the clamps are made in October and not ventilated, as against 8 cwt. per acre when they are made in November. It is therefore advisable to make the clamps as late as possible, and if special weather conditions require the work to be done in October, ventilation becomes a necesssity.

The loss of dry matter increases progressively from autumn to the middle of March ; if the clamps remain untouched for another month, namely up to the middle of April, the loss during this month is equal to the total loss up to the middle of March. This is due to the fact that during the latter period a high percentage of the swedes rot in the clamp. On uncovering it in the middle of March, the loss during the succeeding month was one-third of what it is when the heap was uncovered in the middle of April. In districts in which mangolds are not grown and swedes must be available after the middle of April, it is useful to uncover the clamps in the middle of March. By measuring the temperature of the clamps, one can have an idea of the amount of the loss being caused. For this object special thermometers are made, by means of which the temperature is taken once every three days during the first month and once a week afterwards. If, in some points, an increase of temperature is noticed, it can be lowered by uncovering that part of the heap.

PLANT DISEASES

DISEASES NOT DUE TO PARASITES OR OF UNKNOWN ORIGIN.

1181. – **Further Notes on a Disease of Red Clover in Tuscany** (1). — I. BACCARINI, PASQUALE, and BARGAGLI-PETRUCCI, GINO. — II. DEL GUERCIO, GIACOMO. — *Atti della Reale Accademia economica-agraria dei Georgofili di Firenze*, Series 5, Vol. XI, Part 2. pp. 23-96, figs. 1-12, 1 plate; pp. 133-183, figs. 1-39. Florence, 1914.

I. — The researches of Profs. Baccarini and Bargagli-Petrucci on the disease of *Trifolium pratense* known as "incappucciamento", which first appeared in several parts of Tuscany in 1908, have brought to light several factors concerned in the damage, but without definitely deciding which is to be considered as the true cause of the destructive disease in question.

The theory of degeneration of the seed sown in laying down the crop cannot be accepted in this particular case.

The following fungi have been isolated on several occasions from the diseased clover: *Sclerotinia Trifolium*, *S. sclerotiorum*, sterile mycelia of *Dasyscypha* and *Helotium*, *Phoma* sp., *Botrytis cinerea*, *B. vulgaris*, *Torula* sp., *Fusarium metachroum*. Infection experiments have given results which, though not being definite, lead to the conclusion that the fungi, especially *Sclerotinia Trifoliorum*, *Botrytis cinerea* and *Fusarium metachroum*, cannot be considered as the ultimate causes of the disease.

Four types of bacteria have also been isolated, one of which (type *a*) is more constant and abundant than the others; it is capable of liquefying agar and gelatine and evidently belongs to the genus *Micrococcus*. Inoculations of red clover with this organism have resulted in the production of the chief symptoms of "incappucciamento" in both field and pot cultures. It therefore appears that the ultimate cause of the disease is bacterial infection, probably with the organism of type *a*. Inoculation experiments with this organism tend to show that some lesion, natural or artificial, is necessary for the organism to gain entry. Such lesion may be caused accidentally

(1) See No. 181, *B.* Feb 1914. (*Ed.*)

by moving, or by the action of certain insects or other animals boring in the stems and roots. Certain eelworms (*Heterodera*) have in fact been recorded on the diseased plants, and also insects belonging to *Apion*, *Hylastes*, *Anthonomus* (?), *Cecidomyia*, *Pteromalus*, etc. Of these, the species of *Cecidomyia* were found to be superficially infected by bacteria, among which type *a* was most abundant. The insects cannot be regarded as the primary cause of the disease, but rather as concomitant pathogenic causes (this may also be said of the fungi) and also disseminating agents of the bacteria, which they carry from plant to plant and inoculate direct into the tissues.

It is not very probable that a deficiency of lime in the soil can have given rise to the disease, nor can it be attributed to soil "sickness".

It is quite probable that the extensive floods of the Elsa in 1907 had established soil conditions favourable to an intense development and a rapid spread of pathogenic organisms previously localised or sporadic. Another hypothesis may also correspond to the facts; it is well known that the metabolism of micro-organisms is liable to variations and extraordinary adaptations, and that slight changes in the conditions of the medium are able to control the elaboration or suppression of definite substances (toxins or hormones). It is therefore by no means impossible that variations of the medium may exercise an influence on certain soil organisms so as to render them capable of a pathogenic action once they have gained an entry into the tissues of the plant. From this hypothesis it would appear that the intensity of the bacterial action would gradually diminish as the soil recovered its normal conditon, until it finally disappeared. The progress of this recovery would be facilitated by omitting clover from the rotation and substituting some other forage crop.

II. — Prof. Del Guercio observes that clover attacked by a disease known as "stremenzimento" or "incappucciamento" in the provinces of Florence, Siena, Pisa and Arezzo, showed symptoms which were evidently not due to insect or other animal pests and other symptoms of a different nature caused by worms, molluscs and various arthropods (Crustaceans, Arachnids, Myriapods and Insects).

The following insects are described in detail from the systematic and biological point of view, as pests of clover: *Rhizoberlesia trifolii* gen. et sp. nov., *Aphis scaliae* sp. nov., *Pemphigus trifolii* sp. nov., *Anthothrips* spp., Cecidomyids, *Apion* (especially *A. virens*), *Hylastinus* or *Hylastes trifolii*, etc.

The writer considers that this disease of clover is similar to that causing the dwarfing of other plants and draws the attention of agriculturists to the necessity of good manuring and rotation.

Though there is no doubt as to the damage caused by *Hylastes* and *Apion*, which is more than that due to Cecidomyids and *Tylenchus devastator*, no precise relation between these pests and micro-organisms can be determined in the present state of the researches. At present it can only be said that they are connected with damage to clover. It will be necessary to observe which action begins first and which is more effective in its results. The writer inclines to the opinion that insects and nematodes initiate the trouble and that subsequent developments of the disease are due to bacteria.

Future investigations should concern the relation between the microbes of the clover and of the soil, nematodes, insects and agricultural operations and the disease of clover, with a view to finding the best means of obtaining normal growth of this crop.

1182 – **Blossom-End Rot of Tomatoes.** – BROOKS, CHARLES, in *Phytopathology*, Vol. IV, No. 5, pp. 345-373, plates XXIV-XXVI, figs. 1-5. Baltimore, Md., October 1914.

Blossom-end rot or point-rot of tomatoes, first reported by Galloway in 1888, is of general occurrence in the United States and has been reported from Canada, Cuba, Australia, New Zealand and various parts of Europe.

The first symptom of the disease is a water-soaked appearance on the blossom portion of the fruit, followed by a spot at the base of the style or half a centimeter or more away from it, or, as is more commonly the case, the whole blossom surface of the fruit may be affected. In this stage the disease very much resembles a bruise. In a few days this dark green water-soaked area becomes black, later involving the whole blossom half of the fruit. The affected tissue collapses and becomes firm and leathery. This collapsing of the diseased tissue, together with the continued development of other parts of the fruit, may produce a definite depression on the blossom half of the fruit, but more often it results in only a flattening of the tomato.

The first effects of the disease are not always superficial. Fruit that appears entirely normal from an external view has often the tissue of several or sometimes all of its placentae collapsed and blackened in the parts nearest the blossom. In some cases this internal condition is accompanied by a very inconspicuous depression of the surface tissue above it or by a small water-soaked area on the surface.

The cause of the disease has been attributed to various organisms, *viz. Phytobacter lycopersicum*, *Macrosporium tomato*, *M. Solani*, *Fusarium erubescens*, etc., and many have regarded it as contagious. Recent results seem to show that it is not contagious and that its origin will be found along cultural and physiological lines.

Spraying experiments have generally given negative results, and the majority of authorities attach little importance to this means of control.

Culture experiments have led to the conclusion that neither bacteria, nor fungi, nor enzymes are the cause of this disease. Plants growing under the most favourable conditions are more liable to attack. Continued excessive watering, as well as a drought, may give rise to the disease. Manuring with potash salts in solution increases the disease in proportion to the amount of potash applied, whilst nitrate of soda causes a decrease in the intensity of the disease. These results were not confirmed in the field experiments. Nitrate of soda showed slightly less tendency to increase the disease than sulphate of ammonia or organic fertilisers having an equivalent amount of fertiliser. Heavy applications of horse manure have increased the disease out of all proportion to the increase in vigour of the plants. Plants well supplied with water on a sandy loam have developed less disease than those on a clay loam. Raising the soil temperature of greenhouse plants has increased the disease. The writer is of opinion that the increase in the disease from heavy watering is due to the development of harmful humic and

ammonium compounds and an accompanying decrease in nitrates. Susceptible tissue contains more starch and more oil than normal tissue, and its cell-sap has a higher osmotic value. The protoplasm of the cells from the fruit of the heavily-watered plants is more granular and contains more oil than that of the lightly-watered ones.

BACTERIAL AND FUNGOID DISEASES.

GENERALITIES

1183 - **Contributions to the Cryptogamic Flora of Thuringia.** — JAAP, OTTO, in *Annales Mycologici*, Vol. XII, No. 4, pp. 423-437. Berlin, 1914.

A systematic list of 300 species of Myxomycetes, Schizomycetes and Eumycetes, collected during the month of July in the years 1906 to 1911, in various parts of Thuringia. Some of them are new to Central Germany and also to Thuringia. One of two species of fungi new to Science is *Entomophthora Jaapiana* Bubák, found on the hemipterous pest *Euacanthus interruptus* L. (fam. Jassidae). The list includes numerous fungi living on the resin of spruce, which are very abundant and well developed, especially in the woods near Oberhof.

1184 - **Contribution to the Mycological Flora of Serbia.** — RANOJEVIC, N., in *Annales Mycologici*, Vol. XII, No. 4, pp. 393-421, figs. 1-5. Berlin, 1914.

This third contribution contains 271 species of fungi collected chiefly during 1910 and 1911 and partly during 1913, in various parts of Serbia, and on a large number of plants, many of which are cultivated or otherwise of economic value.

Of these, two genera and 19 species are new to Science; large numbers are new to the district and occur on host plants of economic importance.

The following, amongst others, are either new to Science or fresh records for Serbia: *Podosphaera tridactyla*, on leaves of *Prunus Armeniaca; Leptosphaeria Tritici* on the leaves of wheat; *Uromyces Tropaeoli* sp. nov. on the living leaves of *Tropaeolum majus*; *Phyllosticta Betae* on the leaves of *Beta vulgaris*; *Cicinnobolus Humuli*, parasitic on *Erysiphe Polygoni*, *E. Cichoriacearum* and *Sphaerothoeca Humuli* (1); *Septoria Nupharis* sp. nov. on the living leaves of *Nuphar luteum*; *Dilophospora graminis* on the ears and leaves of wheat; *Oidium Tuckeri* on grapes; *O. quercinum* on the leaves of *Quercus pubescens* and *Q. sessiliflora; Microbasidium Sorghi* (species representing the new genus *Microbasidium*, instituted by Bubák and Ranojevic, and synonymous with *Fusicladium Sorghi* Pass.), on the living leaves of *Sorghum saccharatum*.

1185 - ***Pellicularia Koleroga* injurious to Coffee in Porto-Rico** (2). — FAWCETT, G. L., in *Journal of Agricultural Research*, Vol. II, No. 3, pp. 231-233, figs. 1-3, Washington, D. C., 1914.

In 1912 J. Kuijper reported that comparisons of the fungus causing the disease known as "zilverdraadziekte" of coffee in Surinam with

(1) See in this connection, No. 75, *B.* Jan. 1914. (*Ed.*)
(2) See No. 2983, *B.* Aug.-Sept.-Oct. 1911. (*Ed.*)

the fungus causing the so-called leaf-blight of coffee in Porto Rico led to the conclusion that the latter disease is not identical with the descriptions of *Pellicularia Koleroga* Cooke in India, and observed also that it differed from the fungus causing the " candelillo " disease in Venezuela.

However, considering the mistakes in the original descriptions of fungi causing other coffee diseases, and on the other hand the fact that the descriptions correspond sufficiently with the characters of the fungus found in Porto Rico, it seems justifiable to identify this fungus with *P. Koleroga*. Further, the specimens of *P. Koleroga* collected in Mysore, where Cooke first studied the disease, agree perfectly with those found in Porto Rico. It is therefore erroneous to consider the Porto Rico disease as different from that of *P. Koleroga* Cooke.

The researches on the Venezuela disease (" candelillo ") support the conclusion of Kuijper that the fungus is distinct from *P. Koleroga*, though allied to it.

It is therefore concluded that *P. Koleroga* exists in the Antilles and the South American continent as well as in India, and that a fungus of similar appearance and causing a disease known as " candelillo " has also been found on the continent. This appears to be the only fungus of this nature found in Venezuela and was wrongly identified as *P. Koleroga* Cooke.

1186 – **A Contribution to the Morphology and Life History of *Pestalozzia funerea* Desm.** — WENNER, J. J., in *Phytopathology*, Vol. 4, No. 5, pp. 375-384, plate XXVII, figs. 1-7. Baltimore, Md., 1914. FUNGI

The question of the exact relation of *Pestalozzia funerea* Desm. to the various coniferous hosts on which it has often been recorded in both Europe and America, has for many years been more or less in doubt. Other species of *Pestalozzia* have often been reported as appearing in close relation with diseased plants, yet actual proof of their parasitism is lacking in many cases.

In plate culture, in addition to the typical 4-septate conidia, another kind of spore appeared, resembling a chlamydospore; on germination, this produced a mycelium, the hyphae of which under favourable conditions produced similar chlamydospores, or, on plate and tube cultures, the typical 5-celled conidia.

Inoculation experiments proved conclusively that this species is parasitic under certain conditions, the most important of which appears to be the presence of a great amount of moisture in the air. The fungus is capable of attacking both the leaves and stems of the hosts used in the experiment, *viz.* Weymouth Pine (*Pinus Strobus* L.), Norway spruce (*Picea Abies* [L.] Karst.), and hemlock (*Tsuga canadensis*). The symptoms of the disease are browning of the leaves, followed in some cases by the appearance of superficial mycelium, the drooping of the young shoots, and the development of the acervuli. The shoots finally die and eventually the whole tree is killed.

As means of control, diseased seedlings should be destroyed as soon as detected, and as a preventive, the ordinary methods of spraying with Bordeaux mixture will probably be effectual.

BACTERIAL AND FUNGOID DISEASES OF VARIOUS CROPS

1187. – ***Puccinia Menthae* on *Mentha canadensis* var. *piperascens* in Hungary** (1). — GRÓF, BÉL, in *Kisérletügyi Közlemények*, Vol. XVII, Part. 4, pp. 657-661, 2 figs. Budapest, 1914.

Puccinia Menthae Pers. attacks not only *Mentha arvensis*, *M. crispa* and *M. piperita*, but also *M. canadensis* var. *piperascens*, which has been grown in Hungary for some years.

On this host the aecidium stage develops towards the end of April on the stems of shoots 4 to 6 in. long. It causes a swelling between the first and second node, which results in a curvature of the stem; in some cases the swelling extends over the whole surface of the stem, resulting in twisting. The diseased plants retain green leaves only at the summit, the rest being shrivelled.

Uredospores appear in July and teleutospores at the end of September.

The disease causes a very poor yield owing to the damage to the leaves and the reduced quality of the essence.

Treatment consists in collecting and burning the fallen leaves in autumn and spraying the infected plots with a 2 per cent solution of copper sulphate. The spraying should be repeated in the spring and the crop cut during June before the appearance of the uredospores.

1188 – **American Gooseberry Mildew in Italy** (2). — GREPPI, CARLO, in *Rivista di Patologia vegetale*, Year VII, No. 4, pp. 97-99. Pavia, 1914.

The occurrence of American gooseberry mildew (*Sphaerotheca mors-uvae* [Shwein.] Berk. et Curt.) was recorded on the shoots, leaves and fruits of gooseberries in the middle of May 1914, in a garden at Tromello (prov. of Pavia).

Gooseberries are very little grown in Italy, so that this fungus cannot be of such importance as in other European countries.

1189 – ***Hypochnus Burnati*, a New Fungus on the Vine in Switzerland.** — LENDNER, A., in *Bulletin de la Société botanique de Genève*, 2nd Series, Vol. VI, No. 4, pp. 104-106, 1 fig. Geneva, 1914.

Towards the end of autumn in 1913, several vines growing near to each other in a vineyard at Bossey appeared to be diseased, and peculiar nodular excresences known to French growers as "broussins" were observed on the stems.

Surrounding these tumours was a white felted growth resembling in its characters the fungus *Aureobasidium Vitis* Viola and Boyer, but actually belonging to a new species of *Hypochnus*, described by the writer as *H. Burnati*.

Analysis of the soil showed a high percentage of lime, which the writer considers is the primary cause of the disease. This new *Hypochnus* is considered to be a secondary parasite, or perhaps a saprophyte.

(1) See also No. 1211, *B.* Oct. 1913. (*Ed.*).

(2) See also No. 183, *B.* Feb. 1914; No. 953, *B.* Oct. 1914; and No. 1068, *B.* Nov. 1914. (*Ed.*)

PARASITIC AND OTHER INJURIOUS FLOWERING PLANTS.

1190 – **Parasitic Flowering Plants on Para Rubber Trees in Negri Sembilan (F. M. S.).** — BROOKS, F. T., in *The Agricultural Bulletin of the Federated Malay States*, Vol. II, No. 7, pp. 165-166. Kuala Lumpur, February 1914.

A considerable number of trees in *Hevea* plantations were noticed to be attacked by two kinds of parasitic flowering plants, not yet determined (1), in a manner similar to that in which mistletoe attacks certain trees in Europe. The parasites possess green leaves, but weaken the host by obtaining supplies of water and mineral salts from the branches, to which they are attached by means of suckers. Several of the rubber trees carried many of these parasitic growths, which were evidently doing considerable damage, the portions of the branches beyond the place of attachment of the parasite being killed in a number of cases.

Their simple entire leaves and prominent position on the branches make the presence of these parasites easy to detect.

The area which was most affected by these parasitic plants consisted almost entirely of trees in poor condition. The foliage was thin and it was probably this circumstance which enabled these parasites to become established, for in a tree possessing a healthy and vigorous leaf canopy the light below the crown would probably be sufficiently reduced to prevent the development of these troublesome plants.

All branches bearing such growths should be cut out, and efforts should be made by manuring to stimulate a more vigorous development of the trees, which should be rested until a better leaf canopy has been developed.

1191 – **Experiments on the Food Requirements and Growth of Couch *(Agropyron repens).*** BURMESTER, HERMANN (Breslau), in *Fühlings Landwirtschaftliche Zeitung*, Year 63, Part 16, pp.547-556, 1 fig. Stuttgart, August 15, 1914.

The writer has made a number of experiments with couch-grass (*Agropyron repens*), in completion of those published by Kraus as No. 220 of the *Arbeiten der D. L. G.* (1).

In pot experiments with a light loam soil it was found that pieces of rhizome placed at a depth of 30 cm. (12 in.) did not succeed in reaching the surface, while at 15 cm. (6 in.) the growth made in more than three months was not much less than with pieces at a depth of only 4 cm. (1 ½ in.).

Manurial experiments showed that couch can grow well in very poor soils; when given abundant supplies of nutritive substances it makes a somewhat increased growth, but the increase is by no means proportional to the absorption of these substances, the result being that the plant becomes abnormally rich in the particular nutrients supplied.

In a series of pot experiments in which oats were sown with and without rhizomes of couch, it was found that the yield of grain of the oats was

(1) Probably *Loranthus* spp., which are common parasites on *Hevea*, *Citrus*, and other fruit trees in Malaya. (*Ed.*)

(1) See No. 1472, *B.* Oct. 1912. (*Ed.*).

always distinctly greater when couch was present, while the yield of straw was only slightly reduced ; comparison with similar series in which couch was grown alone showed that the oats had greatly hindered the growth of the couch, reducing it to from 5 to 15 per cent. of the normal.

INSECT PESTS.

GENERALITIES

1192 – **New Coccidae in Japan.** — KUWANA, S. I, in *Journal of Entomology and Zoology*, Vol. VI, No. 1, pp. 1-8, plates I-III. Claremont, Cal., 1914.

A systematic description of the following eight new species of *Coccidae* recently recorded :

1) *Xylococcus napiformis*, on *Quercus serrata*, at Nishigahara, Tokio, and other localities in Japan.

2) *Phenacoccus azaleae*, on the branches and underside of the leaves of *Azalea* ; closely allied to *P. pergandei* Ckll.

3) *Eriococcus festucae*, on *Festuca parvigluma*, at Nishigahara, Tokio (1910) ; closely allied to *E. insignis* Newst. and *E. greeni* Newst.

4) *Pulvinaria citricola*, on *Citrus*, at Okayama, Shizuoka, and on *Diospyros Kaki*, *Hibiscus syriacus*, *Citrus* and other plants at Tokio; closely allied to *P. cellulosa* Green; has one generation per year and is very injurious to *Citrus* at Shizuoka and Okayama.

5) *P. photiniae*, on *Photinia illosa* and *Celtis sinensis*, at Nishigahara, Tokio (1912).

6) *P. okitsuensis*, on oranges, at Okitsu, Shizuoka-ken (1912) ; allied to *P. thespesiae* Green.

7) *P. idesiae* on *Idesia polycarpa* and *Phellodendron amurense*, at Nishigahara, Tokio (1911) ; near *P. horii* Kuw.

8) *Lecanium* (*Eulecanium*) *pseudomagnoliarum*, on *Citrus*, at Tokio and Shizuoka (1911) ; allied to *Lecanium* (*Eulecanium*) *magnoliarum* Ckll. recorded as occurring on *Berberis nepalensis* at Tokio and on the vine at Shizuoka-ken (1912) ; this is the first record of this species in Japan.

MEANS OF PREVENTION AND CONTROL

1193. — **New Species of Hymenopterous Parasites on *Heliothis armigera* and *Caradrina exigua* in Russian Turkestan.** — KOKUJEV, NIKIA, in *Revue russe d'Entomologie*, 1913, Vol. XIII, No. 3-4, pp. 513-514. Petrograd, 1914.

A systematic description of the following new Hymenoptera: *Habrobracon simonovi*, reared from a larva of *Heliothis armigera* Hb. (= *H. obsolela* F.) (1); *Chelonus caradrinae* and *Microplites rufiventris*, obtained from a larva of *Caradrina exigua* Hb. (= *Laphygma flavimaculata* Harr.).

(1) See also No. 2584, *B.* Aug.-Sept.-Oct. 1911; Nos. 125 and 194, *B.* Feb. 1913; No. 203, *B.* March 1913; No. 627, *B.* June 1913; No. 1117, *B.* Sept. 1913. (*Ed.*).

1194 – ***Dichomeris ianthes, Catopsilia crocale* and *Catachrysops pandava*, injurious to Lucerne, Cassias and Cycas in Ceylon.** — RUTHERFORD, A., in *The Tropical Agriculturist*, Vol. XLIII, No. 3, pp. 222-224. Colombo, 1914.

In December 1913, the lucerne at the Experiment Station, Peradeniya, was badly attacked by the caterpillar of the Tineid moth, *Dichomeris ianthes* Meyr., which folds the leaflets from below upwards and eats them in patches. A few of the caterpillars had been parasitised by a small Braconid.

In April 1914, several of the Cassias in the Botanic Gardens were defoliated by the caterpillars of the butterfly *Catopsilia crocale* Cramer. The caterpillars have the habit during the heat of the day of climbing restlessly up and down the trunk and congregating between the limbs at the base of the tree. Advantage was taken of this to feed them with branches of Cassia sprayed with arsenate of lead. These cut branches, however, soon wilted in the strong sunlight. A few Chalcids were noticed about the pupae and several of the caterpillars contained Dipterous puparia. A small number were also attacked by a disease which prevented them from pupating. The surrounding bnshes and trees were covered with pupae. On the underside of one leaf of *Bryophyllum* sp. fifteen were suspended and on another fourteen. Hundreds were found on the neighbouring *Palmyras*, chiefly on the under-surface of the uncut leaf-bases.

Among the pupae crows and king-crows did good work, though the crows did some damage by breaking off leaves and twigs from the more tender plants. The king-crow was also observed feeding greedily on the caterpillars. A branch of parasitic *Loranthus* growing on one of the Cassias was untouched.

In March 1913, the larvae of *Catachrysops pandava* Horsf. attacked the fronds of *Cycas revoluta* in the Botanic Gardens and stripped them almost to the midrib. There were holes in the midrib at intervals, and the inside was eaten out and the cavity full of a blackish or brownish evil smelling frass.

Larvae and pupae were present, often several in the interior of each midrib. In January 1914, these same caterpillars were feeding on the underside of the fronds, eating through to the upper epidermis. They were attended by ants, *Camponotus* sp.

In May of the same year, the young fronds of *Cycas Rumphii* were attacked; they elongated but were reduced to the midrib, which was dead, withered and bent and hung limp at the apex, giving the tree a very unsightly appearance. In this case also holes had been eaten into the midrib, but there was no extensive mining in the interior, probably because there was sufficient food externally to enable them to complete their growth. The butterflies were actually observed ovipositing on the tender fronds. Many of the eggs were ruptured and a minute, brownish ant was observed actively nibbling at the eggs. An application of arsenate of lead when the larvae are young is recommended for this pest.

1195 – **Animal Pests of Camphor in Ceylon.** — RUTHERFORD, A., in *The Tropical Agriculturist*, Vol. XLII, No. 6, pp. 463-468. Colombo, 1914.

The writer describes the following insect pests of camphor (*Cinnamomum Camphora*) in Ceylon :

1) Thrips (probably *Cryptothrips floridensis* Watson, recently described as injurious to camphor in Florida), not previously recorded in Ceylon. It damages the buds, leaves and branches, causing them to blacken and die. Spraying with tobacco decoction is recommended.

2) Leaf-miner of camphor (*Acrocercops* sp.) ; the larva mines under the upper epidermis of the young leaves, causing a large blotch ; the gallery seems to start from any point, but in most cases the narrowest and presumably the earliest part of the gallery occurs towards the base of the leaf and often on the petiole. The larva is parasitised by a Chalcidid and a Braconid very effectively. Spraying the diseased leaves with tobacco decoction is recommended.

3) The large bagworm (*Clania variegata* Snell.) ; the case in which the grub lives is made of brownish-white silk surrounded by pieces of stout twigs lying in a horizontal direction. Probably the best way to deal with this pest is to collect and destroy the caterpillars.

4) Bagworm (probably *Amatissa consorta* Templ.); the case is composed of short pieces of twig arranged in a spiral.

5) Larvae of two species of Pyralid (?), one of which is injurious to the buds and the other to the young leaves.

The following insects are also mentioned :

1) *Xyleborus compactus* Eichh., occurring also on tea, coffee, and avocado pear ; 2) *X. arquatus* Wynne Sampson, which according to Green bores the living branches; 3) *Hylopertha* sp., recorded by Green on dead or diseased wood; 4) *Lepidiota pinguis*, recorded by Green as feeding on the roots ; 5) *Suana concolor*, *Papilio lankeswara*, *P. clytia*, *Attacus atlas*, whose caterpillars are recorded by Green as feeding on the leaves ; 6) twig girdler, a Lepidopterous larva which mines in the young twigs, often causing them to wilt and fall over ; it bears a marked resemblance to the one found feeding in the buds and referred to above, and it is possible they are one and the same species ; 7) *Coptosoma siamicum*, observed feeding on the young shoots; 8) *Aspidiotus* (probably *A. camelliae*) observed on the buds and twigs ; 9) *Tetranychus bioculatus*, recorded by Green as occurring in injurious numbers on the upper surface of the leaves ; 10) *Brevipalpus obovatus*, recorded by Green ; 11) mice, recorded by Green as digging up and devouring seed in the nursery.

1196 **Outbreak of *Malacosoma fragilis* in California.** — VAN DYKE, EDWIN C. (Dept. of Entomology, University of California, Berkeley, Cal.), in *The Monthly Bulletin of State Commission of Horticulture*, Vol. III, No. 9, pp. 351-354, figs. 90-92. Sacramento, Cal., September 1914.

The genus *Malacosoma* (*Lasiocampidae*) contains several species liable to be injurious to various trees, including apples, in California : they are *M. californica* Pack. (on live oaks and apple), *M. constricta* Stretch (on

black and white oaks), *M. pluvialis* Dyer (on alder and apple) and *M. fragilis* Stretch.

The larvae of the last-named, known as the Great Basin tent caterpillar, were found to be present in enormous numbers during the past summer on species of *Ceanothus* forming brush in the country about Mt. Shasta. They appeared early in June ; by the beginning of July, having defoliated the *Ceanothus* bushes, they migrated in vast hosts, attacking the leaves of any trees (except Conifers) they came across : a few reached some apple trees, where they showed themselves as destructive as the other species mentioned above. They also became a great nuisance on the railways, owing to their crushed bodies causing slipping ; eventually the engines were fitted with steam jets to blow them off the rails.

Many of the caterpillars were parasitized by various species of Tachinid flies, which, however, made little impression on the numbers ; others were parasitized by ichneumon flies, while two species of *Calosoma* and two wasps were preying on them.

1197 — ***Phloeotribus scarabaeoides* and *Hylesinus oleiperda*, Beetles injurious to Olives in the Arezzo District, Italy** (1). — DE ROSA, ANTONIO, in *Il Coltivatore*, Year 60, No. 28, pp. 301-305, figs. 47-49. Casale Monferrato, 1914.

Phloeotribus scarabaeoides Bern. (*P. oleae* F.) and *Hylesinus oleiperda* F. (fam. *Ipidae*,) bore galleries in olive branches, and are the cause of considerable damage in the country round Arezzo, especially on the hills facing east near Staggiano.

For the control of these insects the writer recommends: *a*) destruction of the insects during the winter by cutting and burning the diseased branches ; *b*) rational pruning of the trees; *c*) careful cultivation of the soil ; *d*) complete manuring for the trees.

1198. — ***Tetropium gabrieli* var. *crawshayi* on Larch in England.** — OSMASTON, B. B., in *Quarterly Journal of Forestry*, Vol. VIII, No. 4, pp. 277-279, figs. London, 1914.

Tetropium gabrieli var. *crawshayi* has recently been reported on larches in several widely separated localities in England, *viz.* Maer (North Staffordshire), Gerard's Cross (Berkshire) and Hayward's Heath (Sussex).

The insect deposits its eggs in the crevices of the bark of unhealthy trees. The larvae devour the phloem and cambium and even penetrate into the wood before pupating. The tree succumbs quickly and the external layers of the wood,especially the sapwood, show slight damage. Healthy trees do not appear to be attacked. This beetle finds conditions in England favourable to its development, since most larch plantations contain trees attacked by canker (*Dasyscypha calycina* Fuckl.) and by "chermes" (*Chermes laricis* Hartig), and it will not be surprising if it assumes considerable importance in the future.

(1) See also No. 3064, *B.* Aug.-Sept.-Oct. 1911 ; *B.* Oct. 1913, p. 1561 ; No. 1312, *B.* Nov. 1913. (*Ed.*).

Plantations should as far as possible be cleared of all unhealthy or diseased trees. As soon as a tree is attacked by the insect, as indicated by the wilting of the leaves in summer and confirmed by the presence of larvae under the bark, it should be cut down and made into timber or stripped of its bark and the chippings burnt. If the green woodpecker (*Gecinus viridis* L.) is present, the diseased trees may be recognised by the holes in the bark. Dead larches are sometimes found with holes from which the woodpeckers have extracted the grubs, so that only a small number survive to propagate the species.

The following rules are recommended for new plantations: *a*) they should be limited to districts where the larch is known to thrive; *b*) mixed plantations should be made, so as to maintain more natural conditions; *c*) the trees should not be too dense at the time of thinning out as poles.

ALFREDO RUGGERI *gerente responsabile.*

INTERNATIONAL INSTITUTE OF AGRICULTURE
BUREAU OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES

MONTHLY BULLETIN
OF AGRICULTURAL INTELLIGENCE
AND PLANT DISEASES

INDEX 1914

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PREFACE

This index, though arranged alphabetically, retains the grouping of the subjects used in the *Monthly Bulletin*. The arrangement of the subjects in each group is in chronological order of publication, except in the case of those relating to Agricultural Development, where the alphabetical arrangement was considered more useful.

Except in the case of the original articles, which are numbered according to their pages, the numbers of each subject refer to the paragraphs in the *Monthly Bulletin*.

The index consists of three parts : one, of the original articles, one concerned only with Agricultural Intelligence and the last with Plant Diseases.

This volume of contents has been prepared by the redacteur Dr. Giulio Provenzal.

THE INTERNATIONAL INSTITUTE OF AGRICULTURE

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b) Communicate to parties interested, also as promptly as possible, the above information.

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CONTENTS

PREFACE . . . . . *Page* 3

I. — Index of Original Articles . . . . . » 9

II. — Index of Agricultural Intelligence:

A) Subjects . . . . . » 11

B) Authors . . . . . » 55

III. — Index of Plant Diseases:

A) Subjects . . . . . » 67

B) Authors . . . . . » 91

I. — INDEX OF ORIGINAL ARTICLES

ALBERT, F. - The Forests of Chile, *page 1535.*

ALVAREZ, T. & J. A. - Present State of Cattle Breeding in Uruguay, *page 607.*

AMADEO, T. - Agricultural Education in the Argentine Republic, *page 288.*

ARKELL, H. S. - The Present Status of the Cattle Industry in Canada, *page 1255.*

BESANA, C. - The Dairy Industry in Italy at the Present time, *page 842.*

BÖGGILD, B. - Recent Work and Progress in the Dairying Industry in Denmark, *page 167.*

BORDIGA, O. - The Crisis in Italian Sericulture and the Measures for Averting It, *page 1263.*

COCKAYNE, A. H. - The Grass and Clover Seed Industry in New Zealand, *page 1385.*

ERIKSSON, J. - The Control of Plant Diseases in Sweden, *page 1546.*

GERSTUNG, F. - Recent Experience and Progress in Bee-Keeping in Germany. *page 716.*

HAMBERG, H. E. - Present Organization of Agricultural Meteorology in Sweden, *page 6.*

HELWEG, L. - Root-Nodosities of Crosses between Turnips and Swedes, *page 833.*

HOFFMANN, M. - The present Position of the Science of Manuring in Germany, *page 976.*

HOWARD. - The Profitableness of Present-day Sheep-Keeping in Germany especially in Comparison with Cattle and Pig Keeping, *page 30.*

HUTYRA, F. - Protective Inoculations against Swine Fever in Hungary, *page 707.*

JABLONOWSKY, J. - Recent Work of the Royal Entomological Station of Hungary, *page 316.*

KOERFER, ISTVÁN. - The Development of the Dairy Industry in Hungary, *page 1542.*

KRÜGER, E. - The Present State of Irrigation in Germany, *page 294.*

LAUR, R. - Basis of International Statistics of Agricultural Book-Keeping, *page 171.*

LAURIE, D. F. - Report on the Poultry Industry in South Australia, *page 1400.*

LAVENIR, P. - Composition and Agricultural Value of the Arable Lands in the Argentine Republic, *page 9* and *page 145.*

MC CREADY, S. B. - Present Status of Agricultural Education in Canada, *page 571.*

NYÁRÁDY, JÁNOS. - Agricultural Education in Hungary, *page 1143.*

PATER, P. - The Cultivation of Medicinal Plants in Hungary, *page 26.*

PEGLION, V. - Reclamation in the Province of Ferrara, Italy, *page 1146.*

PRIEGO, J M. - Present State of Fruit Growing in Spain (Principal Fruit Trees of the Rosaceae), *page 836*.

RUDDICK, J. - Present State of the Dairying Industry in Canada, *page 162*.

RÜMKER, VON K. - Present State of Agricultural Education in Germany *page 578*.

SCHMIDT, KÁROLY. - The Present Condition of Forestry in Hungary, *page 1391*.

SIMOIS, D. L. - Cultivation of Sugar Cane in the Argentine Republic, *page 424*.

SPENCER, J. B. - The Swine-Raising Industry in Canada, *page 1154*.

STUTZER, A. - The Testing of Calculation according to Kellner's Starch-Values in Practical Feeding in Germany, *page 155*.

TACKE. - Recent Experience and Progress in Moor-Cultivation in Germany, *page 313*.

TIMBERG, G. - Trials of Agricultural Machines in Sweden, *page 158*.

TULLGREN, A. - Work of the Entomological Section of the Swedish Central Agricultural Experiment Station during the Years 1907-14, *page 1410*.

VAN DER ZANDE, H. M. - Agricultural Education in the Netherlands, *page 971*.

VESTERGAARD, A. B. - Present State of Plant Breeding in Denmark, *page 419*.

VINASSA DE REGNY, P. - The Study of Agricultural Geology in Italy, *page 19*.

WALKER-TISDALE. The Dairy Industry of Great Britain, *page 985*.

WALLACE, R. and WATSON, J. A. S.- The Cattle Industry in Britain, *page 306*.

WATSON, J. A., *see* WALLACE, R.

WAUTERS, P. - Instruction in Agricultural Housekeeping in Belgium, *page 1*.

WEINZIERL, VON TH. - Seed Control in Austria and its Effect upon Agriculture and Trade, *page 299*.

WEISER, ISTVÁN. - Recent Work of the Royal Hungarian Station of Biology and Animal Nutrition, *page 432*.

ZAPPA R. - The Cattle Industry in Italy at the Present Day, *page 598* and *page 712*.

ZUNTZ, N. - Experiments and Points of View in the Study of Animal Metabolism with the aid of the Respiratory Apparatus, *page 435*.

II. — AGRICULTURAL INTELLIGENCE

A) INDEX OF SUBJECTS.

ABACA : The Present System of Grading ; its Defects and Remedy, 124.
Abies bracteata, 506.
Abies religiosa, 506.
Abrus precatorius, 36.
Abutilon vitifolium, 506.
Acacias : The Selection of Land for Plantation in The Tropics, 11. An Economic Study, 137. *Acacia Cavenia* in Chile, *page 1535*.
Achillea Millefolium, 1009.
Aconite : *Aconitum Vilmorinianum*, 506. *Aconitum Napellus*, 1009.
Acorus Calamus, 1009.
Acrocomia Sclerocarpa, 28, 237.
Actinidia Henryi, 506.
Actinomycosis in Carp, 156.
Adansonia, *see* Baobab.
Adsorption, selective, by Soils, 204.
Adulteration and Fraud : Marigold for the Adulteration of Saffron, *page 29*. Seeds Used for Adulteration of *Abrus precatorius*, 36. A New Method of obtaining Milk Serum and its Importance in the Detection of Watered Milk, 178. Impurities in Seeds in Victoria, Australia, 516. Fraudulent Introduction of Dead Lobsters in the Parcels sent to Market by Certain Breeders, 840.
Africa : French West Africa : Observations on the Origin and Distribution of Breeds of Cattle, 649. German East Africa : The Development of Agriculture, 195. Some Data on the Agriculture, 300. Manurial Experiments, 319. The Most Important Tannin Yielding Plants, 436. Technical Organization, 593. German South-West Africa : Development of Farming, 2. Development and Prospects of Sheep Breeding for Wool, 552. South Africa : Chemical Composition of Rain, 494. Agricultural Education, 592. Progress in Irrigation, 603. Cotton, 1113. Medicinal Plants, 1123.
Agave *see* Sisal Hemp.
Agricultural Book-Keeping, *see* Book Keeping.
Agricultural Education, *see* Education and Experimentation in Agriculture and Forestry.
Agricultural Improvements : *Suaeda fruticosa* for the Fixation of Shingle Beaches, 245. Land Reclaimed in the Province of Ravenna, Italy,

The figures in italics refer to the number of the page, the others to the number of the abstract.

413. Reclamation and Improvements in the Roman Campagna, 773. Reclamation in the Province of Ferrara, *page 1146*. Improvement of Waste Land in the Netherlands, 812. A New Way of Utilizing the Energy of Peat Beds, 813. The Ombrone Diversion for the Reclamation of the Plain of Grosseto, Italy, 878. Stump Burning to Reclaim "Logged off" Lands. - 937.

Agricultural Institutions: The "Société Nationale d'Agriculture de France", 8. Union of Women's Agricultural Association in Prussia, 404. Formation of an Agricultural Office for Tripoli, 701. The Reorganization of the Experimental Garden at Hamma, near Algiers, 875. The Royal Colonial Garden at Palermo, 977.

Agricultural Shows, *see* Shows.

Agrostis alba and *A.* [sp., *page. 1387*.

Akaroa Cocksfoot, *p. 1388*.

Alang-Alang, *Imperata arundinacea*, 250.

Albania, The Agricultural Conditions, 489.

Alcohol, The Industrial Uses of Maize when cultivated for Sugar, 631. The Alcohol Content of Yeast, 776. Some Products of the Banana, 1054.

Alerce, *Fitzroya patagonia, page* 1539.

Aleurites of Tonking, 899.

Alfalfa *see* Lucerne.

Algaroba, 1035.

Algarroba, *Prosopis jutiflora*, 1127.

Algarrobo, *Caesalpinia brevifolia* and *Prosopis siliquastrum, p. 1541*.

Algeria, Olive Growing in the District of Tizi-Ouzou, 898.

Alligator Pear, *see Persea gratissima*.

Almond in Australia, 744.

Alopecurus pratensis, p. 1387.

Alsyke, p. 1387.

Althea officinalis, p. 29, 1009.

Aluminium: The Occurrence of Aluminium in Plants, 21. The Aluminium Reduction Method as Applied to the Determination of Nitrates in « Alkali » soils, 206.

Amoora Rohituka, 235.

Amylometer, a New Apparatus for Estimating the Starch Content of Potatoes, 338.

Analysis of Agricultural Products: Analyses of *Mentha crispa* in Hungary, *p. 27*. Analysis of Willow Ashes, 23. Gru-Gru Palm Kernels (*Acrocomia sclerocarpa*) in Trinidad, 28. A Perfume Plant from West Africa: *Popowia Capea*, 35. Determination of the Amount of Water added to Milk based on the Degree of Acidity, 65 The Composition of Ewes' Milk Sold in Hungary, 67. A New Butyrometer for Determining the Amount of Fat in Cheese, 176. On the Composition of Giant Kelps, 212. Composition of Ewes' Milk Butter, 282. Composition and Properties of Some Casein and Paracasein in Compounds and their Relations to Cheese. 283. Titration of Milk with Alcohol at Different Degrees of Concentration, 380. The Chemical Composition of Florida Oranges, 442. Note on the Displacement Curves of Organic Bases and their Application to the Determination of the Strength of Alkaloids, 510. Determination of the Viscosity of Milk as a Means of Detecting the Addition of Water, 569. Analysis of Sugar-Beets, 739. Preserving Milk Samples for Examination, 852. The Composition and Value of Bat Guano, 879. The Aroma of Hops: Studies of the Essential Oil and its Relation to Geographical Distribution of Hops. 885. Determination of the Tartaric Acid in Wines by Physico-Chemical Vo-

lumetric Analysis, 947. Composition of Essence of *Artemisia arborescens* and of *A. Absinthium* collected in Italy, 1006. The Chemical Composition of the Tobacco Plant in its Various Stages of Growth. 1008. Physico-Chemical Volumetric Estimation of Potash and Magnesia and its Application to Wines. 1052. Studies on the Extraction of Olive Oil, 1055. Fractional Analysis of Wheat, 1098. Methods of Estimating Carbohydrates. II. The Estimation of Starch in Plant Material, 1100. The Origin, Quantity and Signification of Lactic Acid in certain Italian Wines, 1168. The Cause of Acidity in Fresh Milk of Cows and a Method for the Determination of Acidity, 1172.

Anatomy and Physiology of Live Stock: Studies of the Endogenous Metabolism of the Pig as modified by Various Factors, 41. Experimental Rachitis in Young Animals, the Offspring of Parents Deprived of the Thyroid Gland, 139. Metabolism during Pregnancy and the Lactation Period, 140. The Udder as an Emunctory: Elimination of Artificial Colouring Matter by the Udder, 255. Experiments and Points of View in the Study of Animal Metabolism with the aid of the Respiratory Apparatus, *p. 435*. The Problem of Early Maturity in Breeding from the Biological Point of View, 447. Sugar in Blood Plasma, 538. Influence of Fluorine on the Animal Organism, 539. The Effect on the Milk Glands of Volatile Fatty Acids from the Food, 1020. On Ovariotomy in Sows; with Observations on the Mammary Glands and The Internal Genital Organs, 1140. On Some Factors Controlling Fertility in Domestic Animals, 1141. Research on the Transformation of Energy in the Domestic Fowl, 1142. *See also*, Feeding.

Andira jamaicensis, 1035.

Andropogon, 999.

Anise, Cultivation in Hungary, *p. 29*, Cultivation in England 1009. *See also Illicium verum*.

Anona, in Australia, 744, in South American, 745.

Anthemis montana, 506.

Anthemis nobilis see Camomile.

Apples: Present State in Greece, 132. In Spain, *p. 836*. Winter Spraying of Fruit Trees with Nitrate of Soda, 638. In Australia, 744.

Apricots: Yield per Acre in Spain *p. 840*. Growing in Australia, 744. In Russian Turkestan, 829.

Araucaria imbricata, *p. 1541*.

Arctium Lappa, 1009.

Arctostaphylos arguta, 506.

Argentine Republic. Composition and Agricultural Value of the Arable Lands, *p. 9*. and *p. 145*. Agricultural Demonstration Train at Rosario de Santa Fé, 7. The Condition of the Dairy Industry in the Argentine Republic in 1912, 280. The Cultivation of Sugar Cane, *p. 424*. Agriculture, 490. Argentine Lucerne Seed, 623. Karakul Sheep, 653. Fruit Growing, 745. Cultivation of Cotton, 1004.

Aristotelia Macqui, 506 and 745.

Aromatic Plants and Spices: The Cultivation and Commerce of Aniseed, *Illicium Verum* Hook, 437. In the Italian Somaliland, 874. Essential Oil of *Ocymum pilosum*, 904. Composition of Essence of *Artemisia arborescens* and of *A. absinthium* collected in Italy, 1006. *See also*, Anise Cinnamon, Cloves, Saffron etc.

Arrayan, *Myrceugenia apiculata*, *p. 1541*.

Arrhenatherum elatius, *p. 1387*.

Arsenic, The Presence of Arsenic and Manganese in some Feeding Stuffs, 1021.

Artemisia arborescens and *A. absinthium* 1007; *A. Pulegium*, 1009. *See also*, Medicinal Plants.
Artocarpus incisa, 643.
Arundinaria Falconeri and *A. humilis* var. *gracilis*, 506.
Arundo conspicua, 506.
Asimina triloba, 506.
Aspidium Filix-Mas, 1009.
Asses and Mules, In German South-West Africa, 2. In Tripolitania, 45. In Southern Italian Somaliland, 257. In Argentine Republic, 490. Short-faced Abyssinian Mules, 546.
Atropa Belladonna, *See* Belladonna.
Australia, Impurities in Seeds in Victoria, Australia, 516. The Great Artesian Basin of Australia, 602. The Cultivation of Poppies for Opium and Seed in Various Countries, 636. Fruit Growing, 744. Report on the Poultry Industry in South Australia, *p. 1400*. *Eleusine indica* (Crowfoot Grass) in Queensland, Dangerous to Stock, 1016. The Wool Clip in Australasia in the Year 1913-1914, 1063.
Austria: The Private Economic Conditions of Moravian Peasant Farmers, 61. Sugar-Beet Farming in Austria-Hungary, 168. Seed Control in Austria and its Effect upon Agriculture and Trade, *p. 299*. The Significance of the Fluctuations in the Price of Cereals for the Profitableness of the Moravian Peasant Farms, 276. Legislative Measures Relating to the Trade in Silkworm Eggs, 298. Silesian Grazing Farms, 376. Influence of the Distance from the Market on Farming in Fifty Moravian Farms, 465. Present State of Milk Record Associations in Austria, 547. Austrian Experiments in Inoculating Leguminous Crops with Nodule Bacteria, 609. The Motor Plough Trials at Litowitz and at Komotan Hagensdorf, 662. Experiments in Growing Medicinal Plants at Korneuburg in 1913, 827.
Automatic Drinking Trough, 275.
Avellano, *Gevuina Avellana*, *p. 1541*.
Avocados: Promising Plant Immigrants in the Philippines, 438. In South America, 745. *Persea gratissima* Gaert. and *Machilus glaucescens* Wight, 750, 1035.
Azalea candida, 506.
Azara microphylla, 506.
Azotogen, 609.

BACCHARIS PATAGONICA, 506.
Bacterial Flora of Some Fresh or Fermenting Concentrated Foods and its Effect on Milk, 1022.
Bacteriology and Soil Organisms: Culture Experiments on Sick Soils, 14. *Bacillus radicicola* and Preparations for Soil Inoculation, 209. The Bacterial Treatment of Peat, 410. Methods in Soil Bacteriology, Ammonification and Nitrification in Soil and Solution, 496. The Absence of Nitrate Formation in Culture of Azotobacter, 497. The Mechanism of Denitrification, 498. The Functions of the Non-Bacterial Population of the "Bacteria Bed", 499. Experiments on the Rate of Nitrification, 598. The Influence of Irrigation and Crop Production on Soil Nitrification, 601. Austrian Experiments in Inoculating Leguminous Crops with Nodule Bacteria, 609. Relations of Certain Higher Plants to the Formation of Nitrates in Soils, 707. Recent Experience in Farming on Moors, 807. The Number and Growth of Protozoa in Soil, 810. Relation of Bacterial Transformations of Soil Nitrogen to Nutrition of Citrus Plants, 811. Influence of Lime on Soil Bacteria, 814. Azoto-

bacter in Connection with Nitrification, 1089. Recent Inoculation Experiments on Virgin Sphagnum-Moor Soils, with Various Cultures of Bacteria of Leguminosae, 1096. *Azotobacter chroococcum*, 1101.

Baillonella toxisperma, 627.

Baking Qualities of Flour as influenced by Certain Chemical Substances, Milling By- products and Germination of the Wheat, 383. *see also* Milling Industry.

Balm, *p. 29*, 1009.

Bamboos in North Africa, 435.

Bambusa Nagashima, 506.

Bananas: The Selection of Land for Plantation in the Tropics, 11. The World's Trade in Bananas, 532. In Australia, 744. Some Products of the Banana, 1054. The Manuring of Bananas, 1130.

Baobab, Fruits and Seeds from the East African Protectorate, 238.

Barberry, 1009.

Barley: Distribution of Manure in Drills, 218. Observations on some Characters of Hard and Tender Barleys, 229. Present State of Selection in Denmark, *p. 419*. Some Characteristics of the Endosperm of Chevallier and Goldthorpe Barleys, 332. Production in Argentine Republic, 490. Investigations on Barley in Connection with the Separation of the Glumes through Rapid Drying, 517. Manurial Experiments on Malting Barley carried out at the Vienna Experimental Station, 621. Influence of Potash and Phosphoric Acid on the Quality of Malting Barley, 622. The Early Fruwirth Goldthorpe Barley, 728. Report on the Field Trials with Barleys organized in 1913 by the Barley-growing Station of the Brewers' Institute of Berlin, 819. Production in Sweden, 870.

Bassia latifolia, 235.

Bat Guano, Composition and Value, 879.

Beans: Studies on Differential Mortality in the Germination of Seeds, 110. Eight Years' Cultivation Experiments with Beans, 230. The Tepary, a New Cultivated Legume from the South-West States, 231. Xenia in *Phaseolus* Crosses, 721.

Beckmania cruciformis, 732.

Bee–Keeping: Observations on the Practice and Profitableness of Beekeeping in Switzerland in 1912, 170. Recent Experience and Progress in Beekeeping in Germany, *p. 716*. The Olfactory Sense of the Honey-Bee. 554. Bee-Keeping in Sweden, 870. New Research on the Visual Power of Bees, 934. Apiculture in Ireland, 935. Collection and Exportation of the Wax of Wild Bees in the African Colonies, 936. Book-Keeping Statistics on the Profitableness of Bee-Keeping in Switzerland, 943. Bee-Keeping in Portorico, 1035. Apiculture in Uganda, 1155.

Beets, *see* Sugar-Beets.

Belgium: Instruction in Agricultural Housekeeping, *p. 1*.

Belladonna: In Hungary *p. 29*. Individual Variation in the Alkaloid Content of Belladonna Plants, 112. Selection, 117. The Cultivation and Collection in England, 1009.

Belloto, *Bellota Miersii*, *p. 1541*

Berberidopsis corallina, 506.

Berberis vulgaris, 1009.

Binders, Team-hauled and Self-propelling, 660.

Biorisator, Experiments, 781.

Birdsfoot Trefoil, *p. 1387*.

Bittersweet, 1009.

Boldo, *Boldoa fragrans*, *p. 1541*.

Bollen, *Kageneckia obliqua*, *p. 1541*.

Bombax, 734.

Book-Keeping: Basis of International Statistics of Agricultural Book-Keep-

ing, *p. 171.* Intermediate Valuation of "Not Marketable" produce of the Farm in Agricultural Book-Keeping, 166. Institution of an Agricultural Book-Keeping office at the German Section of the Council of Agriculture for the Kingdom of Bohemia, 172. Association for obtaining Probatory Power for Agricultural Book-Keeping and for Furthering the Science of Farm Management, 173. An Example of Agricultural Book-Keeping on the Card System, 279. Book-Keeping Competition for Small and Medium sized Farms in East Prussia, 669: Book-Keeping Results: Five-Year Averages obtained at the Accountants' Office of the German Agricultural Society, 774. The Organization of Team Work according to the Results of Book-Keeping and to Net Returns, 847. Development and Present Situation of Milk Recording and Book-Keeping Associations in Denmark, 851. Statistics on the Profitableness of Bee-Keeping in Switzerland, 943. Statistical Data on the Economy of the Farms Belonging to the Cooperative Book-Keeping Association of Königsberg in Prussia, 1165.

Boracera madagascariensis, 555.

Borassus flabelliformis, 39.

Borneo: Recent Data on Rubber Plantations, 1117.

Borreira ocimoides, 1035.

Botany, Agricultural: Studies on the Stem-Anatomy of Wheat and its Bearing on Classification, 228. Comparative Histology of Alfalfa and Clovers, 351. Report of the Imperial Economic Botanist for India, 1913, 502. Nodosities on Roots of Swede-like Hybrids and of Turnip-like Hybrids, *p. 834.* Composition of Various Starches, 610. The Determination of the Quality of Starch in Rice Grains, 611. The Movement of Potash in Plant Tissues, 612. The Effect of one Crop upon another, 716. The Action of Certain Nutrient and Non-nutrient Bases on Plant Growth, 717. The Distribution of Stomata in the Seedlings of Some Gramineae, 817. Coloration of the Seed Coat of Cowpeas, 882. Comparative Morphology of Some Leguminosae, 985.

Botoncillo, *Borreria ocymoides*, 1035.

Bourbon: Production of Vanilla, 825.

Boxwood, *Casearia praecox*, 1132.

Boyd's Clover, *p. 1387.*

Breadfruit, Propagation of the Seedless, 643.

Bread making *see* Milling Industry.

Breeding of Live Stock: Sheep-Keeping in Germany, *p. 30.* In German South West Africa, 2. In Tripolitania, 45. The Profitableness of Milk Farms, 63. Situation and Problems of Live-Stock Breeding and Keeping in Modern Intensive Agriculture, 165. Cost of Rearing a Calf, 169. The Cattle Industry in Britain, *p. 306.* In the German Colonies, 300. Stock Breeding in Southern Italian Somaliland, 357. The Condition of the Breeders' Associations in Germany, 358. The Cattle Industry in Italy, *p. 598.* Live-Stock in Morocco, 544. Live-Stock in New Caledonia, 545. Present State of Cattle Breeding in Uruguay, *p. 607.* The Present Status of the Cattle Industry in Canada, *p. 1255.* In Sweden, 870. Animal Husbandry in Sardinia, 927. Scale of Points for Judging a Mixed Dairy Farm, 1026. Some Data on the Animal Products and the Control of Rabbits in New South Wales, 1913, 1027. *See also* Genetics of Live Stock.

Breeding, Plant, *see* Plant Breeding.

Brewing: Manurial Experiments on

Malting Barley carried out at the Vienna Experimental Station, 621. Influence of Potash and Phosphoric Acid on the Quality of Malting Barley, 622. Report on the Field Trials with Barleys organized in 1913 by the Barley-growing Station of the Brewers' Institute of Berlin, 819.

Bromelia, see Pine-apple.

Bromus unioloides, *p. 1386.*

Broom, 1009.

Brown Top, *pag. 1387.*

Brugiera gymnorrhiza, 436.

Buckbean, 1009.

Buffalo Skins, the Preparation for Export from the French Colonies, 783.

Building Construction: Fireproofing of Wood, 462. Cheap Stable Walls, 463. Feeding Box for Poultry, 464. The Shower-Bath System of Sheep Dipping, 566. Foundations on Explosion Piles in Compressible Soils, 664. Bold Concrete Dam, 1163.

Bulgaria: Legislative Measures Relating to the Trade in Silkworm Eggs, 298.

Burdock, 1009.

Butter: Researches made at the Dairy Institute at Alnarp, Sweden, 64. Complete Churning and Questions connected with it, 68. Danish Import and Exports of Butter, *p. 169.* Composition of Ewes' Milk Butter, 282. Industry of Great Britain, *p. 985.* Importation and Exportation in Sweden, 870. Production in New South Wales, 1027. Payment for Milk and Cream Supplies, 1059. New Observations on the Origin of the Taste of Swedes in Butter, 1061.

Butyrometer for Determining the Amount of Fat in Cheese, 176.

CABBAGE: The Toxicity of Soil to Cabbage after a Crop of Sesame, 210. Nodosities, *p. 386.*

Cacao: Selection of Soil for Plantation in the Tropics, 11. In the German Colonies, 195 and 300. The Budding of Cacao, 443. The Cultivation of Cacao in Trinidad and the Gold Coast, 740. In Réunion, 976.

Caesalpina brevifolia, *p. 1541.*

Cajanus indica, 555.

Cake: Enrichment of Farmyard Manure by Cake Feeding, 15. Utilization of Para Rubber Seeds, 240.

Caldeluvia paniculata, *p. 1541.*

Calliphora rufifaciens, 1017.

Calophyllum Inophyllum, 235.

Camellia japonica, 506.

Camels: In German South West Africa, 2. In Italian Somaliland, 357.

Canada: Forest Protection, 38. Present State of the Dairying Industry, *p. 162.* Present Status of Agricultural Education, *p. 571.* Cost of Producing, Marketing and Exporting Wheat, 468. Poultry-Farming, 658. The Swine Raising Industry, *p. 1154.* Present Status of the Cattle Industry, *p. 1255.* Experiments with Autumn Sown Crops in Ontario in 1911, 1110.

Canavalis ensiformis, 1023.

Canelo, *Drimys Winteri*, *p. 1541.*

Capé, 35.

Capsicum annuum, 527.

Capuili, 745.

Caraway, 1009.

Carapa sp., 236.

Carbon, *Cordia decandra*, *p. 1541.*

Carobs in Greece, 132.

Carp, Actinomycosis, 156.

Carpenteria californica, 506.

Carrya Thureti, 506.

Cart. A New Cattle Cart, 372.

Carthamus tinctoria, 235.

Carum Carvi, 1009.

Casearia praecox, 1132.

Casein: Composition and Properties of Some Casein and Paracasein Compounds and their Relation

to Cheese, 283. Caseinogen and Casein, 471. The Phosphorus Content of Casein, 1176.

Castanospis chrysophylla, 506.

Cattle Egret, or Buff Backed Heron Attempts at Breeding in Madagascar, 933.

Cattle Keeping: The Profitableness of Present-day Cattle Keeping, *p. 30*. In German South-West Africa, 2. Studies in Milk Records, 46. Comparative Investigations into the Performance of the Breeds of Cattle kept in the Province of Saxony, Prussia, 47. The Freiburg Pied Mountain Cattle and their Employment for Crossing with the German Black-spotted Lowlands, 48. An American View on the Beef Cattle Situation. Present Status of the Industry, 49. Colour in Shorthorn Cattle, 151. The Influence of Feeds on the Quantity and Fat and Bacterial Content of Milk, 152. Cause of Difference of Income Tax in Two Pure-bred Dairy Cattle Farms, 167. Cost of Rearing a Calf 169. The Cattle Industry in Britain, *page 306*. Cattle-Feeding Experiments, 258. A Study of the Udder Flora of Cows, 259. Some Data on the Live Stock of the German Protectorates, 300. Breeds of Cattle in Southern Italian Somaliland, 357. Calf-Feeding with Blatchford's Calf Meal, 359. Studies of the Irish Kerry Cow, 360. The Cattle Industry in Italy at the Present Day, *p. 598* and *712*. Present State of Cattle Breeding in Uruguay, *p. 607*. The Cost of Raising a Dairy Cow, 469. In Argentine Republic, 490. In Morocco, 544. Present State of Milk Record Associations in Austria, 547. Red Flemish Cattle, 548. Determination of Growth in Grazing Cattle, 549. Heredity of Twin Births in Cattle, 550. Crossing Bison and Cattle, 648. Observations on the Origin and Distribution of Breeds of Cattle in French West Africa, 649. Connection between Growth of Bone, Horn Development and Performance in Cattle, 650. Raising and Fattening Beef Calves in Alabama, 651. Cattle-Breeding and Dealing in Senegal, 652. Experiments on the Profitable Feeding of Milch-Cows, 755. Report of the Dickinson County Cow-testing Association, 928. Comparison between the Observed and Calculated Production of Heat in Cattle, 1028. Calf Rearing Experiments in Hungary, 1029. Indian Cattle in the Philippines, 1030. Holstein Milk Yield, 1150. Economical Cattle Feeding in the Corn Belt, 1151. Comparative Cost of Food for a Heifer, Stall-fed or at Grass, up to her First Calving, 1160. *See also* Breeding.

Cây-trau, 899.

Ceara, *see Manihot Glaziovii*.

Centaury, 1009.

Cereals: The Significance of the Fluctuations in the Price of Cereals for the Profitableness of the Moravian Peasant Farms, 276. In Denmark, *p. 419*. In the German Protectorates, 300. Cereals Indigenous to Mongolia, 329. Contributions to the Question of the Frost-Resistance of Cereals, 330. A New Appliance for Elevating Grain and Granular Goods, 369. *Triticum monococcum*, 424. Tillage Experiments in Algeria, 709. Trials of the Zehetmayr Method of Drilling Cereals carried out in Sweden, 710. The Distribution of Stomata in the Seedlings of Some Gramineae, 817. In Sweden, 870. The Experiment Farm at Genale, Italian Somaliland 874. *See also* Wheat, Oats, etc.

Ceriops Candolleana, 436.
Camomile, *p. 29*, 1009.
Chañar, *Gourliea decorticans*, *p. 1541*.
Cheese : Coating cheeses with Paraffin, 64. Promoting the Formation of Eyes in Emmental Cheeses, 69. Canadian Cheese, *p. 163*. A New Butyrometer for Determining the Amount of Fat in Cheese, 176. Faulty Milk in Cheese-making : its Detection and Prevalence, 177. Composition and Properties of Some Casein and Paracasein Compounds and their Relations to Cheese, 283. The Question of the Formation of Fat from Protein during the Ripening of Cheese, 382. Industry of Great Britain, *p. 985*. The Action of the Enzymes due to Organisms on the Rind of Hard Cheeses, 782. Industry in Sweden, 870. An Investigation into the Composition of Cheese made from Whole Milk, 949. On the Characteristic Flavour of Roquefort Cheese, 950. Action of Bacteria on the Ripening and Flavour of Cheese of the Cheddar Type, 1174. The Part Played by Micro-organisms in the Ripening and in the Production of the Pungent Flavour of Brindza, the Ewes' Milk Cheese made in Hungary, 1175.
Chelidonium majus, 1009.
Chemistry and Physiology of Plants : Research on Vegetable Physiology, 19. The Water Requirement of Plants in the Great Plains, 20. The Occurrence of Aluminium in Plants, 21. A Study of the Methods of Estimation of Carbohydrates, especially in Plant Extracts, 22. Analysis of Willow Ashes, 23. The Stomatal Characteristics of Sugar Cane, 24. Studies on Differential Mortality in the Germination of Bean Seeds, 110. On the Assimilation by Plants of Nitrogen in the Form of Tyrosine, 111. Individual Variation in the Alkaloid Content of Belladonna Plants, 112. Effects of Illuminating Gas on Vegetation, 113. Variations in Osmotic Pressure in Potatoes during Storage, 114. The Use of Radium as a Means of Forcing Plants, 221. Phosphoric Substance in Meadow Hay, 222. Influence of Radio-active Emanations on Vegetation, 322. Research on Vegetable Physiology, 503. The Resistance of Leguminous Seeds to High Temperatures, 504. The Survival of Plant Tissues after Frost, 505. The Effects of the Winter of 1913-1914 on Certain Plants, 506. The Indicator Significance of Vegetation in the Tooele Valley, Utah, 507. The Error in Water Culture Experiments due to the Presence of Traces of Zinc in Glass, 508. Contribution to the Study of the Formation of Hydrocyanic Acid in Plants, 509. Note on the Displacement Curves of Organic Bases and their Application to the Determination of the Strength of Alkaloids, 510. The Action of Manganese on Plant Growth, 613. Action of Thorium on Seeds, 614. Rocks and Soils in their Relation to the Nutrition of Plants, 705. The Relation of Atmospheric Evaporating Power to Soil Moisture Content and Permanent Wilting in Plants, 816. Influence of Pressure on the Structure of Roots, 884. The Aroma of Hops, Studies of the Essential Oil and its Relation to Geographic Distribution of Hops, 885. Assimilation of Atmospheric Nitrogen by Plants, 887. Physiological Researches on the Germination of the Pollen of *Vitis vinifera*, 888. The Exchanges between the Plant and its Nutritive Solution, 986. The Influence of the Osmotic Pressure of the Soil Solution on the Growth of Spring Wheat, 987. The Action of

Various Electrolytes on the Grain of *Avena sativa*, 988. Effect of High Frequency Currents in Plants, 989. Influence of X-Rays on Vegetation, 990. A Study of the Germinating Power of Seeds, 991. Fractional Analysis of Wheat, 1098. Studies on the Mulberry Leaf, 1099. Estimation of Starch in Plant material, 1100. Some Accessory Factors in Plant Growth and Nutrition, 1102. The Controlling Influence of Carbon Dioxide in the Maturation, Dormancy and Germination of Seeds, 1107.

Cherry : The Pollination of the Sweet Cherry, 345. In Spain, *p. 836*. In Australia, 744.

Chestnut Hybrids in America, 348.

Chewing's Fescue, *p. 1386*.

Chili : Fruit, 745. The Forests, *p. 1535*.

China : Legislative Measures Relating to the Trade in Silkworm Eggs, 298. Manurial Experiments on a German Estate in China, 416. Silkworm Rearing in the Yalong Valley, China, 556. The Cultivation of Poppies for Opium, 636. The Manchurian Timber Industry, 1015. The Consumption of Fertilisers in South China, 1097.

Chloris gayana, 999.

Churn, 159, 271.

Cicuta : Studies on the Toxicity of *Cicuta* or Water Hemlock, 916.

Cipres, *Libocedrus chilensis ;* Cipres de Guaitecas, *L. tetragona, p. 1541*.

Ciruela, 1035.

Ciruelillo, *Embothrium coccineum, p. 1541*.

Cistus hirsutus and *C. purpureus*, 506.

Citropsis, a New Tropical Genus allied to *Citrus*, 533.

Citrus Fruits : The Ichang lemon, 134. The Kumquat, *Citrus japonica*, 440. Relation of Bacterial Transformations of Soil Nitrogen to Nutrition of Citrus Plants, 811. *Eremocitrus*, New Genus of Citrus Trees from Australia, 913. *See also* Oranges, Lemon, etc.

Clematis Armandi, 506.

Clerodendron foetidum, 506.

Clover : Rye-Grass and Clover in India, 341. Comparative Histology of Alfalfa and Clovers, 351. A Study of the Germinating Power of Seeds, 991.

Cocksfoot, *p. 1386*.

Coconut : Selection of Land for Plantation, 11. The Pollination of the Coconut, 248. In the German Colonies, 300. In Australia, 744. Manurial Experiments on Coconuts at Peradeniya, 1129.

Coffee : Selection of Land for Plantation in Tropics, 11. In the German Colonies, 195 and 300. The Relation between an Abundant Rainfall and the Production of Coffee, 243. Precautions for the Growing and Transplanting of Liberian Coffee, 523. Coffee in Tonking, 633. Mocha Coffee Culture, 634. Coffee Cultivation in Uganda, 824. *Coffea excelsa* and its Cultivation, 902. In Réunion, 976. *Inga laurina* and *I. vera*, plants for bees, 1035.

Coihue, *Nothofagus Dombeyi, p. 1541*.

Colchicum autumnale, 1009.

Cold Storage, *see* Refrigeration.

Coltsfoot, 1009.

Comfrey, 1009.

Congo Belgian, Agriculture, 3. In Uele, 91.

Congresses : 10, 96, 198, 303, 406, 492, 596, 703.

Conium maculatum, 1009.

Copper, Sulphate of Copper : Production, Trade and Consumption, 108.

Copra in the German Colonies, 195, 300.

Cordia decandra, p. 1541.

Coriander, 1009.

Cotton : The Selection of Land for Plantation in the Tropics, 11. Seed

Selection of Egyptian Cotton in Arizona, 116. Cotton Cultivation and the Cotton Industry throughout the World, 121. In the German Colonies, 195, 300. The Artificial Ripening of Cotton, 233. The Frequency of Low Temperatures in the Sudan and its Effects on the Cotton Crop, 304. Cotton in Asiatic Russia, 342. The Utilization of the Proteins of Cotton Seed by Man, 475. In the Argentine Republic, 490. Studies in Indian Cottons, the Vegetative Characters' 626. Mutation in Egyptian Cotton, 993. Cotton in Paraguay and Argengentina, 1004. Irrigation Scheme for Sind: The Development of Cotton, 1091. Cotton in South Africa, 1113.

Cover Crops: *Dolichos Hosei*, 906. *Inga laurina* and *Inga vera*, 1035.

Crested Dogstail, *p. 1387*.

Cryptocarya Peumus, *p.* 1541.

Chrysanthemum Parthenium, 1009.

Cuba: Palms Indigenous, 883. The Effect of Shading on the Transpiration and Assimilation of the Tobacco Plant in Cuba, 1122.

Cucumber, The India, 438.

Cultivation, Methods of: *see* Tillage.

Cultivators: Trial of a Spring-Tooth Cultivator, 55, 762.

Cupania americana, 1035.

Cymbopogon coloratus, 34, 638.

Cynosurus cruciformis, 732.

Cyprus: Mechanical Requisites, 373.

Cytisus scoparius, 1009.

Da, *Hibiscus cannabinus*, 239.

Dactylis glomerata, *p. 1386*, *p. 1535*, 992.

Dairying: Studies in Milk Records, 46. The Profitableness of Milk Farms, 63. Summary of the Results of Researches made during the Last Few Years at the Dairy Institute at Alnarp (Sweden), by L. F. Rosengren, 64. The Relationship between the Bacterial Flora of Milk and of the Pasture, 66. Complete Churning and Questions connected with it, 68. Present State of the Dairying Industry in Canada, *p. 162*. Recent work and Progress in the Dairying Industry in Denmark, *p. 167*. The Influence of Feeds on the Quantity and Fat and Bacterial Content of Milk, 152. New Churn, 159. Influence of Pasteurizing on the Fat Globules of Cream. Preliminary Research, 174. Bacterial and Enzymic Changes in Milk and Cream at 0°C, 175. A New Method of obtaining Milk Serum and its Importance in the Detection of Watered Milk, 178. The Condition of the Dairy Industry in the Argentine Republic in 1912, 280. The Cost of Milk Production in the Counties of Kent and Surrey, 378. In Argentine Republic, 490. Present State of Milk Record Associations in Austria, 547. Present State of Milk Recording for Goats in the German Empire, 553. The Effect of Certain Dairy Operations upon the Germ Content of Milk, 571. The Dairy Industry in Italy at the Present Time, *p. 842*. Cost of Production of Milk and Beef, 667. Purification and Disposal of Waste Water from Dairies, 677. The Activity of Cooperative Dairies in Hungary in 1911-12, 678. The Dairy Industry of Great Britain, *p. 985*. International Union of Municipal Dairies, 779. The Supply of Milk to Indian Cities, 780. The Position of Non-Breeding Dairy Farm in Modern Agriculture, 846. Development and Present Situation of Milk Recording and Book-Keeping Associations in Denmark, 851. Present State in Sweden, 870. Report of the Dickinson County Cow-Testing As-

sociation, 928. The Bacterial Flora of Some Fresh or Fermenting Concentrated Food and its Effect on Milk 1022. Scale of Points for Judging a mixed Dairy Farm, 1026. Payment for Milk and Cream Supplies, 1059. The Development of the Dairy Industry in Hungary, *p. 1542*. The Hygienic Importance of Acid-Rennet Bacteria in the Udders of Cows, 1134. Poisoning by *Sorghum halepense*, 1135. *See also*, Milk, Butter Cheese etc.

Dam, Concrete, 1163.

Dandelion, 1009.

Danthonia pilosa and *D. semiannularis*, *p. 1386*.

Date Palm: The Selection of Land for Plantation, 11. Propagation of the Date Palm, 909. Date Palms from Irak, 910. The Effect of Climatic Conditions on the Rate of Growth of Date Palms, 978.

Datura Metel, *D. Stramonium*, *D. Tatula*, 1009, 1123.

Denmark: Recent Work and Progress in the Dairying Industry, *p. 167*. Present State of Plant Breeding, *p. 419*. Report on the Work of the State Seed-testing Station, 515. Development and Present Situation of Milk Recording and Book-Keeping Association, 851. Innovation in the Danish Trade in Seeds of Root Crops, 891.

Denitrification *see* Bacteriology.

Dessiccator *see* Drying.

Development of Agriculture in Different Countries: The Agricultural Conditions of Albania, 489. In Argentine Republic, 490. In Belgian Congo, 3, 91. In the German Colonies, 195, 300. In Réunion, 976. In Servia, 90. In Sweden, 870. In Tripoli, 401.

Digitalis purpurea, 1009.

Dill, 1009.

Distilleries: Co-operative Distilleries in the Pays de Caux, France, 673. *See also* alcohol.

Dolichos Hosei, 906.

Dracaena tesselata, 635.

Drainage: Irrigation and Drainage in the United States, 412. Tile-Drain Trench-Digger, 761. Recent Experience in Farming on Moors, 807.

Drills: New Beet Seed Dibbling Machine, 157. New Hand Drills, 559. A New Mulcher and Seeder, 763.

Drimys Winteri, *p. 1541*.

Drought: Distribution of Drought, 199. Drought-resistant Grasses and Fodder Plants, 999.

Drying of Agricultural Products: Potato Drying as Auxiliary Industry for Distilleries, 274. Potato-Drying Works in the German Empire, 674. Artificial Hay-Drying, 844. *See also* Esiccator.

Drypetes glauca, 1035.

Ducks, A Further Study of Size Inheritance in Ducks, with Observations on the Sex Ratio of Hybrid Birds, 353. In New South Wales, 1027.

Duddleia macrostachya yunnamensis, 506.

Dumoria Heckeli, 627.

Dunes: Cereals Indigenous to Mongolia for the Fixation of, 329, 812. *See also* Sandy soils.

EDUCATION and Experimentation in Agriculture and Forestry: Instruction in Agricultural Housekeeping in Belgium, *p. 1*. Agricultural Instruction for Soldiers, 5. The Agricultural and Veterinary College at Rio de Janeiro, Brazil, 6. Agricultural Demonstration Train at Rosario de Santa Fé (Argentina), 7. The Imperial Japanese Tohoku University at Sapporo (Island of Yesso), 93. The Rural Travelling Housekeeping Schools in Prussia in 1912, 94. Agricultural Education

in the Argentine Republic, *p. 287*. Grants for Agricultural Education and Research in England and Wales in the Year 1912-13, 196. The Establishment of a Laboratory at the Marseilles Colonial Institute for the Study of Cereals and other Starch-producing Plants, 301. Present Status of Agricultural Education in Canada, *p. 571*. Present State of Agricultural Education in Germany, *p. 578*. Popular Agricultural Education in Hungary, 402. The Institute for Agricultural Botany and the Institute for Seed Selection in Bavaria, 403. Union of Women's Agricultural Associations in Prussia, 404. Agricultural Education in South Africa, 592. Technical Organization in German East Africa, 593. Agricultural Education in the Netherlands, *p. 971*. In Hungary, *p. 1143*. Courses of Instruction for Teachers in Rural Continuation Schools in Prussia, 806. In Sweden, 870, in Panama, 873.

Eggs: Export and Import of Tripolitania, 45. Bacteriology of the Hen's Egg with Special Reference to its Freedom from Microbic Invasion, 261. Export in Sweden, 870. Production in New South Wales, 1027. *See* Poultry.

Egypt: Phosphate Beds in Egypt, 321. The Cultivation of Poppies for Opium and Seed, 636.

Egyptian Henbane, 1009.

Elaeis: Selection of Land for the Plantation of, 11. The Oil Palm, 27. Yield and Returns from Palm Oil Trees in French Guinea, 126. In the German Colonies, 300. Mechanical Treatment of Oil Palm Fruits, 476. The Oil Palm (*Elaeis guineensis*), 735.

Elder, 1009.

Electricity: Criticism of the Experiments on the Influence of Atmospheric Electricity on Plants, 109. The Electromotor and the Small Farm, 263. Technical Precautions Necessary in the Electrification of Crops, 604. The Electric Field in the Maturation of Wine, 775. Effect of High Frequency Currents on Plants, 989.

Electro-potash (« Electro-Kali »), 420.

Eleusine indica, 1016.

Elevating, A New Appliance for Elevating Grain and Granular Goods, 369.

Eloeagnis Simonii, 506.

Embothrium coccineum, *p. 1541*.

Encouragement of Breeding: *see* Breeding.

Engineering, Farm, *see* Machinery and Implements, Agricultural; Building Construction, etc.

Ensilage: A New Process of Preparing Potatoes for Acid Ensilage with Pure Culture or Lactic Bacteria, 474. Bacteriological Research on Ensilaged Forage, 541, 923. Preparation of Ensilage, 1143. The Influence of Temperature on the Microflora of Hay, 1145. Experiments on Storing Swedes during the Winter in Denmark, 1180.

Ercilla spicata, 506.

Eremocitrus, 913.

Eriobotrya Japonica, 744.

Erodium pelargonifolium, 506.

Eruca sativa, 235.

Erythrea Centarium, 1009.

Escallonia pulverulenta, 506.

Esicator: "Germania" Potato Esiccator with Oil Heating, 561. A New Esiccator for Paddy, 843.

Espino comun, *Acacia Cavenia*, *p. 1541*.

Ethiopia: The Climate, 1087.

Eucalyptus coccifera, 506.

Eucheuma populosa, 1057.

Eucryphia cordifolia, *p. 1541*.

Eugenia apiculata, 506.

Exhibitions, *see* Shows.

Experiments *see* Education and Experimentation.

FAGUS CUNNINGHAMI, 506.

Feeds: The Nutritive Value of Potato Distiller's Slop and of the Substance from which it is Made, 143. Pig Fattening Experiments with Manioc Roots, 154, 654. The Organic Phosphoric Acid of Cottonseed Meal, 257. Comparative Histology of Alfalfa and Clovers, 351. Calf-Feeding with Blatchford's Calf Meal, 359. The Food Value of Certain Grasses, 540. Toxic Bran, 542. The Rate of Liberation of Hydrocyanic Acid from Linseed, 543. The Industrial Uses of Maize when Cultivated for Sugar, 631. Utilization of Potato and Jerusalem Artichoke Haulms, 645. Feeding Experiments with Rice Gluten Food, 646. The Importance of the Inorganic Constituents of Feeding Stuffs, 752. Feeding Experiments with Lupin and Horse-Chestnut Flakes, 753. Effect of Long Storage of Meadow and Clover Hay on its Composition and Digestibility, 831. The Value of Different Kinds of Straw as Fodder, 832. Investigations into Factors affecting the Handling of Wheat Hay, including a Study of its Digestibility, 922. Bacteriological Research on Ensilaged Forage, 923. The Bacterial Flora of Some Fresh or Fermenting Concentrated Foods and its Effect on Milk, 1022. The Food Value of the Jack Bean, *Canavalia ensiformis*, 1023. The Preparation of Ensilage, 1143. The Forage Value of Redshank, *Polygonum lapathifolium*, 1144. The Influence of Temperature on the Microflora of Hay: Lactic and Butyric Hays, 1145. The Food Value of *Stizolobium aterrimum* and *S. pachylobium* Beans, 1146. *See also* Feeding, Ensilage, Forage Crops.

Feeding: New Method for Calculating the Value of Foods from the Point of View of the Production of Milk, 42. The Testing of Calculation according to Kellner's Starch-Values in Practical Feeding in Germany, *p. 155*. The Digestion of Crude Fibre by Sheep and Pigs, 141. The Influence of Butter-fat on Growth, 142. The Nutritive Value of Potato Distiller's Slop and of the Substances from which it is Made, 143. The Effect of Sugar on the Digestion of Nitrogen, 256. The Organic Phosphoric Acid of Cottonseed Meal, 257. Studies on Phytin, 448. The Food Value of Certain Grasses, 540. Bacteriological Research on Ensilaged Forage, 541, 923. Recent Work of the Royal Hungarian Station of Biology and Animal Nutrition, *p. 432*. Experiments and Points of View in the Study of Animal Metabolism with the aid of the Respiratory Apparatus, *p. 435*. Utilization of Potato and Jerusalem Artichoke Haulms, 645. Feeding Experiments with Rice Gluten Food, 646. Experiments on the Profitable Feeding of Milch-Cows, 755. Investigations into the Metabolism and the Potential Energy of Foods in Growing Pigs, 756. Effect of Long Storage of Meadow and Clover Hay on its Composition and Digestibility, 831. The Value of Different Kinds of Straw as Fodder, 832. The Contribution of Bacteria to the Faeces after Feeding Diets Free from Indigestible Components, 833. Influence of Food Poor in Lime on the Composition of Growing Bones, 921. Investigation into Factors affecting the Handling of Wheat Hay, including a Study of its Digestibility, 922.

Live-Stock Feeding Experiments in Ireland, 1912-13, 924. The Presence of Arsenic and Manganese in some Feeding Stuffs, 1021. The Bacterial Flora of Some Fresh or Fermenting Concentrated Foods and its Effect on Milk, 1022. The Food Value of the Jack Bean (*Canavalia ensiformis*), 1023. Has the Dry Matter in the Various Root Crops the Same Food Value? 1024. Common Salt as a Poison for Stock, 1025. The Forage Value of Redshank (*Polygonum lapathifolium*), 1144. The Food Value of *Stizolobium aterrimum* and *S. pachylobium* Beans, 1146. Statistics of British Feeding Trials and the Starch Equivalent Theory, 1147. Feeding Experiments with Whole Milk and Skimmed Milk with Cream Substitutes, 1148.

Fennel, 1009.

Fermentation: Results obtained by the Distribution of Pure Hungarian Yeast Cultures in 1912, 670. Influence of Chloroform and of Oil of Mustard on the Alcoholic Fermentation of Grape-Must, 672. The Value and Use of Millet Malt., 675. The Alcohol Content of Yeast, 776. Vinification by means of Ferments other than Wine Yeasts, 1051. The Influence of Radioactive Emanations on Yeasts and Alcoholic Fermentation, 1053.

Festuca saburicola, *p. 1386*.

Feverfew, 1009.

Fibre Crops: African *Bombax*, 734. In the Italiam Somaliland, 874. *Urena lobata*, 1114. *Agave Sisalana* and *Fourcroya gigantea*, 1115. *See also* Hemp, Flax, Cotton etc.

Figs in Greece, 132; in Australia, 744.

Figwort, 1009.

Filter: Centrifugal Milk Filter "Albissa", 272.

Fiorin, *p. 1387*.

Fir: In Hungary, *p. 1391*. The Balsam Fir, 1014.

Fish Breeding: On the Relation between the Fat Content and Natatory Powers of Fish, 50. In Switzerland, 1038.

Fitzroya patagonica, *p. 1541*.

Flax: Report on the Flax Experiments at Dooriah (Bengal) during 1912-13, 123. Cultivation in Argentine Republic, 490. Methods and Results of the Selection of Flax in Russia, 511. The Rate of Liberation of Hydrocyanic Acid from Linseed, 543. Experiments in Ireland, 1001.

Flour, *see* Milling.

Flower Trade in France, 680.

Fluorine, Influence on the Animal Organism, 539.

Foeniculum capillaceum, 1009.

Forage Crops: Rye-Grass and Clover in India, 341. The Classification of the Bacteria of Leguminous Plants, 428. The Kudzu Vine (*Pueraria Thumbergiana*), a New Forage Plant in Florida, 432. A New Forage Plant (*Lolium mutliflorum*, 433. Cultivation Experiments with *Vicia striata* in Hungary, 1908-11, 520. Determination of Certain Species of *Carex* by their Vegetative Characters, 624. *Beckmannia erucaeformis* Host, a New Grass for Moor Meadows, 732. A Fodder for the Dry Season: *Tripsacum fasciculatum* Trinius, 733. In Sweden, 870. In Italian Somaliland 874. The Grass and Clover Seed Industry in New Zealand, *p. 1385*. Comparative Morphology of Some Leguminosae, 985. Grasses at Hawkesbury Agricultural College, New South Wales, 997. Senegal Perennial Rice as Forage, 998. Drought-resistant Grasses and Fodder Plants 999. The Food Value of the Jack

Bean, *Canavalia ensiformis*, 1023. *See also*, Lucerne, Clover, Oats etc.

Forestry: Forest Protection in Canada, 38. The Palmyra and Dum Palm in West Africa, 39. Study of Acacias, 137. The Cultivation of Teak in Java, 250. Acreage in Sweden, 870. The Alpine Limit of Forest Growth, 915. In Hungary, *p.1391*. Manchurian Timber Industry. 1015. The Forests of Chile *p. 1535*. Tree Growth and Seed, 1106. Experiments on the Grazing of Woodlands, 1133.

Fork; Swift's New Hay Elevator Fork, 1042.

Fourcroya gigantea and *Agave sisalana*, 1115.

Fowls *see* Poultry, Eggs.

Foxglove, 1009.

France: The "Société Nationale d'Agriculture de France", 8. Farming Conditions in the Department of Puy-de-Dôme, 62. Legislative Measures Relating to the Trade in Silkworm Eggs, 298. The Institution of a Technical Commission of Agricultural Meteorology at the "Direction Générale des Eaux et Forêts", 299. The Recent Valuation of Land other than Building Land, 467. The Trade in Agricultural Machines in France, 557, 563. Effect of Low Winter Temperatures during 1913-14 on Wheat in the Ardennes, 620. The Cultivation of Poppies for Opium and Seed, 636. Vine growing in Champagne, 641. Wine-Making, 671. Co-operative Distilleries in the Pays de Caux, 673. Transport of Agricultural Produce, 680. Edible and Poisonous Fungi from the Nancy District, 718.

Francoa ramosa candida, 506.

Fraud and Falsifications *see*, Adulterations and Fraud.

Frost: Eight Years' Cultivation Experiments with Beans, 230. Frost Protection in the Limoneira Lemon Orchards, 346. The Survival of Plant Tissues after Frost, 505. The Effects of the Winter of 1913-14 on Certain Plants, 506. Protection of Vines against Spring Frost, 531.

Fruit-growing: Present State of Fruit Growing in Greece, 132. The Pollination of Fruit Trees in Relation to Productiveness and Planting, 133. The Composition of Irrigated and Non-Irrigated Fruits, 247. Relation of Precipitation to Tree Growth, 306. Blooming Periods and Yields of Fruit in Relation to Minimum Temperatures, 439. New or Noteworthy Fruits, 444. Respiration of Fruits and Growing Plant Tissues in Certain Gases, 477. Californian Table Grape, the Successful Storage of, 478. Agriculture in the Argentine Republic, 490. Development of the Fruit Industry in Baluchistan, 502. Fruit Growing in Spain *p.* 836 Fletcher and Becker's Fruit Grader, 560. Winter Spraying of Fruit Trees with Nitrate of Soda, 638. The Effect of Dust from Cement Mills on the Setting of Fruits, 639. Fruits Growing in Australia, 744. South American Fruit, 745. Avocados: *Persea gratissima* and *Machilus glaucescens*, 750. Fruit and Vine Growing in Central Asia, 829. The Experiment Farm at Genale, Italian Somaliland, 874. Cultivation of European Fruit Trees in Tonking, 908. New Fruits on North American Markets, 911. Encouragement of Olive Growing and Fruit Growing in Tripolitania, 975. *Prosopis juliflora* the Mesquite or Algaroba Tree; and *Prosopis pubescens*, the Screw Bean, 1127. *See also* Citrus fruits, Cherry etc.

Fuchsia Riccartoni, 506.

Fulica atra,, 454.
Fungi: Edible and Poisonous Fungi from the Nancy District, 718.
Funtumia clastica, 737, 1086.

GABOON: Production of Vanilla, 825.
Gardening: Experiments in Bulb Growing in the United States, 131. Promising Plant Immigrants in the Philippines, 438. In the Argentine Republic, 490. In Germany, 743. In Italian Somaliland, 874, In Réunion, 976. New Garden Plants of the Year 1913, 1010. Pruning Hardy Shrubs, 1011. In Spain, 1124. *see also* Fruit Growing.
Garrya elliptica, 506.
Gas: Effects of Illuminating Gas on Vegetation, 113.
Genetics of Live Stock: A Study of the Correlation between Racing Performances and Breeding Value in Brood Mares, 43. Colour Inheritance in Swine, 44. A Cross Involving Four Pairs of Mendelian Characters in Mice, 145. Heredity and Regeneration of the Testis in Birds, 146. On the Zygotic Constitution of Dominant and Recessive Whites in the Silkworm, *Bombyx mori* L., 147. Non Disjunction of the Sex Chromosomes of *Drosophila*, 148. A Note on Sex Determination, 352. A Further Study of Size Inheritance in Ducks, with Observations on the Sex Ratio of Hybrid Birds, 353. Rudimentary Parthenogenesis in the Golden Pheasant, 354. Some New Varieties of Rats and Guinea-Pigs and their Relation to Problems of Colour Inheritance, 355. "Dominant" and "Recessive" Spotting in Mice, 356. Multiple Factors in Mendelian Inheritance, 449. Observations on the Origin and Distribution of Breeds of Cattle in French West Africa, 649. Preliminary Notes on the Heredity of Certain Characters in a Cross between Silky and Yokohama Fowls, 925. Studies on Inheritance in Pigeons; Hereditary Relations of the Principal Colours, 926.
Geranium, 33.
Germander, 1009.
Germany: The Profitableness of Present-day Sheep Keeping in Germany, Especially in Comparison with Cattle and Pig Keeping, *p. 30*. Agricultural Instruction for Soldiers, 5, The Rural Travelling House-keeping Schools in Prussia in 1912, 94. Cost of Rearing a Calf, 169. The Development of Agriculture in the German Colonies, 195. The Present State of Irrigation, *p. 394*. Recent Experience and Progress in Moor-Cultivation, *p. 313*. Some Data on the Agriculture of the German Protectorates, 300. Manurial Experiments in the German Colonies, 319. The Condition of the Breeders' Associations in Germany in 1912, 358. Two years' Results from the Cooperative Pasture at Coswig, in Anhalt (Germany), 377. Present State of Agricultural Education, *p. 578*. The Institute for Agricultural Botany and the Institute for Seed Selection in Bavaria, 403. Union of Women's Agricultural Associations in Prussia, 404. Budget of the Prussian State Studs for 1914, 540. Recent Experience and Progress in Beekeeping, *p. 716*. Present State of Milk Recording for Goats in the German Empire, 553. Imports and Exports of Agricultural Machines and Implements into and out of Germany in 1913, 564. The New Standards Adopted in Germany for the Trade in Sugar-Beet and Mangel Seeds, 594. Five Years' Manuring Experiments in East Prussia, 606. Work and Wages

of Foreign Labourers in Prussia, 666. The German Imperial Commission of 1912-13 on the Cattle and Meat Trades, 668. Book-keeping Competition for Small and Medium Sized Farms in East Prussia, 669. Potato-drying Works in the German Empire in 1908-09, 1909-10. 1910-11, 674. The Present Position of the Science of Manuring, *p.* 976. The Market-Gardening Districts of Northern Germany, 743. Agricultural Storehouses in Bavaria (Financial Year 1912-13), 784. Course of Instruction for Teachers in Rural Continuation Schools in Prussia, 806. Formation of a German Sheep-breeders' Union, 835. Typhus in Young Pigs in Germany, 1018. Statistical Data on the Economy of the Farms, 1165. Contributions to the Cryptogamic Flora of Thuringia, 1183.

Germination: International Factors connected with the Physiology of Germination in Wheat Grains, 720. The Inheritance of Germination Energy, Germination Capacity and Sensitiveness to Light in Seeds of *Poa pratensis*, 722. Researches on the Germination Capacity and on the Capacity of the Plumule to Emerge from the Soil, 723. A Study on the Germinating Power of Seeds, 991. *See also* Seed.

Gevuina Avellana, *p.* 1541.

Goats: African Goats and Angora Goats in German South-West Africa, 2. In the German Protectorates, 300. In Italian Somaliland, 357. In Argentine Republic, 490. In Germany, 553. The Angora Goat, 836. The Age of Goats according to their Teeth, 930.

Gold Coast: the Cultivation of Cacao, 740. Rubber Plantation, 1117.

Golden Seal, 1000.

Gomoterga nitida, 745.

Goricke, Milk Separator, 271.

Gourleia decorticans, *p.* 1541.

Grassland *see* Meadows.

Great Britain and Ireland: The Cattle Industry, *p.* 306. Grants for Agricultural Education and Research, 196. On Season and Crops in the East of England, 200. Correlation between Meteorological Conditions and Crops in the East of Scotland, 201. Grassland in Britain: Types and their Formation, 340. The Cost of Milk Production in the Counties of Kent and Surrey, 378. The Dairy Industry, *p.* 985. Apiculture in Ireland, 935. The Cultivation and Collection of Medicinal Plants, 1009.

Greater Celandine, 1009

Greece: Present State of Fruit Growing, 132.

Grevilea robusta, 824.

Groundnuts in the German Colonies, 195.

Gru-gru, *Acrocomia sclerocarpa* 28 and 237.

Guadeloupe: Production of Vanilla, 825.

Guama, *Inga laurina*, 1031.

Guanidin: Experiments on the Value of Nitrate of Guanidin and Nitrate of Urea in comparison with Nitrate of Soda and Nitrate of Ammonia, 815.

Guano: The Situation of Guano in Peru, 107. Agricultural Schools in Panama, 873. Prohibition of Collection of Guano in the Ballestas Islands, Peru, 1095.

Guara, *Cupania americana*, 1035.

Guava, *Inga vera*, 1035.

Guayacan, *Porlieria hygrometrica*, *p.* 1541.

Guiana: Production of Vanilla, 825.

Gulgul, 347.

HAND BEET-LIFTER, 765.

Hard Fescue, *p.* 1387.

Hazel nuts in Australia, 744.
Hawaii: The Effect of Heat on Hawaiian Soils, 315. The Rice Soils of Hawaii, 316. Ornamental Hibiscus, 344. The Papaya, 642.
Helianthemum roseum, 506.
Hemlock, 1009.
Hemp: Experiments in Hungary with Hemp Seed from Asia Minor and from Italy, 234. Cultivation in the German Protectorates, 300. A Study on the Germinating Power of Seed, 991. Contribution to the Study of the Lodging of Hemp, 1002. Hemp in the United States, 1003.
Henbane, 1009.
Heron: Attempts at Breeding the Great White Heron and the Buff-Backed Heron (Cattle-Egret) in Madagascar, 933.
Hevea: Utilization of Para Rubber Seed, 240. The Coagulation of the Latex of *Hevea brasiliensis*, and its Bearing on the Strength of Rubber, 522. Hevea in Cochinchina, 629. Manuring Experiments with Hevea, 736.
Hibiscus: Contribution to the Study of *Hibiscus cannabinus* L., 239. In Hawaii, 344. Report of the Imperial Economic Botanist for India, 1913, 502.
Hides and Skins: Import and Export in Tripolitania, 45. Fur-Farming in Canada, 51. In German Protectorates, 300. Buffalo Skins, 783. Import and Export in Sweden, 870. In New South Wales, 1027. Libyan Hides and Skins, 1179.
Holcus lunatus, *p. 1387*.
Honey: The Biological Examination of, 472. Industry in Sweden, 870.
Hops: On the Appearance of Sterile "Dwarfs" in *Humulus Lupulus* L., 512. Studies on the Essential Oil and its Relation on Geographic Distribution of Hops, 885. Studies on the Fertilization of Hops, 903.
Horehound, 1009.
Horses: In German South West-Africa, 2. A Study of the Correlation between Racing Performances and Breeding Value in Brood Mares, 43. Stock Production and Export in Tripolitania, 45. Colour Inheritance in the Horse, 144. Comparative Digestion Experiments on Equidae, 149. The South Oldenburg Horse and the Economic Conditions of its District, 150. In the German Potectorates, 300. Budget of the Prussian State Studs for 1914, 450. In Argentine Republic, 490. Causes and Effects of Cryptorchism, 537. In Morocco, 544. Colt-breeding in Pennsylvania, 647. Breeding Ardenne Horses in Sweden, 754. The Breeds of Horses in Norway, 834. In Sweden, 870. The Breeds of Horses of the Sunda Archipelago, 1149.
Huahuan laurela, *Laurelia serrata*, *p. 1541*.
Huinque, *Lomatia ferruginea*, *p. 1541*.
Humidity of the Atmosphere: An Improved Cog Psychrometer, 808.
Hungary: The Cultivation of Medicinal Plants, *p. 26*. Study of Hungarian Soils by Means of their Water Solutions, 207. Purchases of Tobacco made by the State Monopoly in Hungary in 1912, 242. Piroplasmosis of Cattle in Hungary, 253. Recent Work of the Royal Entomological Station, *p. 316*. Recent Work of the Royal Hungarian Station of Biology and Animal Nutrition, *p. 432*. Legislative Measures Relating to the Trade in Silkworm Eggs, 298. Royal Hungarian Institute for Plant Breeding, 323. Popular Agricultural Education, 402. Protective Inoculations against Swine Fewer, *p. 707*. Recent Work of the Royal Hungarian Central Ampelological Institute at Budapest, 529. The Activity of Coope-

rative Dairies in Hungary in 1911-12, 678. Agricultural Education, *p. 1143*. Present Condition of Forestry, *p. 1391*. The Development of the Dairy Industry, *p. 1542*. Piroplasmosis in Cattle in Hungary in 1913 : Means of Control, 1137.

Hydrastis canadensis, 1009.

Hydraulics: The Hindia Barrage on the Euphrates, 414. The Great Artesian Basin of Australia, 602. The Ombrone Diversion for the Reclamation of the Plain of Grosseto, Italy, 878. Bold Concrete Dam, 1163. *See also* Irrigation.

Hydrocyanic Acid: Contribution to the Study of the Formation of Hydrocyanic Acid in Plants, 509. The Rate of Liberation of Hydrocyanic Acid from Linseed, 543. The Estimation of Hydrocyanic Acid in Feeding-Stuffs and its Occurence in Millet and Guinea Corn, 1101.

Hygiene of Live Stock: Malignant Oedema in Sheep, 40. Rinderpest: Further Investigations on Questions Connected with the Economical Production of Antiserum, 138. New Investigations into the Life History of the Two Warble Flies of Cattle, 251. The Natural Infection of Calves with Tubercle Bacilli, 252. Piroplasmosis of Cattle in Hungary, 253. Scab and its Cause, with Special Consideration of Chamois Scab, 254. Effect of Smoke on Stock Farming, 349. A Preliminary Report on the Investigations of Bovine Red Water (Cystic Hematuria) in Washington, 350. Investigations into the Life History of the Warble Fly (*Hypoderma bovis*, Geer) and Means of Destroying it, 445. Abortion in Sheep, 446. Protective Inoculations against Swine Fever in Hungary, *p. 707*. Research on the Life History of the Large Warble Fly and Means of Controlling it, 534. Practical Observations on Contagion in Anthrax of Cattle, on the Diminution of Cases by Vaccination and on Uniform Immunization, 535. Swine-pox in Young Pigs, 536. Causes and Effects of Cryptorchism, 537. Results of Preventive Inoculation against Foot and-Mouth Disease in Hungary, 1913, 644. Chemical Composition of Moor Hay Provoking Excessive Licking in Cattle, 708. Investigations on the Presence of Tubercle Bacilli in the Flesh, Blood, and Intermuscular Lymphatic Vessels of Tuberculous Calves, 751. Experiments on the Control of Warble Flies in Germany, 830. Studies on the Toxicity of *Cicuta* or Water Hemlock, 916. Experimental Investigations into the Cause of Pernicious Anaemia or Typhoid Anaemia in Horses, 917. Microfilariae in Horses affected by Haemorrhagical Boils, 918. Effect of Low Temperatures on the Bacilli of Anthrax, 919. Vaccination against Hog Cholera, 920. *Eleusine indica*, Crowfoot Grass, in Queensland, Dangerous to Stock 1016. The Sheep Maggot Fly, *Calliphora rufifaciens* and its Parasite, 1017. Typhus in Young Pigs in Germany, 1018. Control of Cattle Ticks and of the Diseases Spread by them, 1019. The Hygienic Importance of Acid-Rennet Bacteria in the Udders of Cows, 1134. Poisoning by *Sorghum halepense*, 1135. The Modifications produced in the Anthrax Bacterium by Means of Ultra-Violet Rays, 1136. Piroplasmosis in Cattle in Hungary in 1913: Means of Control, 1137. Preventive Inoculation against Sheep and Swine Pox, 1138. Studies on Fowl Cholera: The Inheritance in Rabbits of Immunity to Infection with the Bacterium of Fowl Cholera, 1139.

Hygiene, Rural: On the Hygienic Organization of Workers in the Tropics, 4. Recent Research on the Causes of Pellagra and New Views on its Cure, 92. The Utilisation of the Proteins of Cotton Seed by Man, 475. Control of Beri-Beri: Curative action of Autolysed Yeast against Avian Polyneuritis, 871. American Black Flies, 872.
Hyosciamus niger, 1009.
Hymenea Courbaril, 1035.
Hypericum polyphyllum, 506.
Hyphoene thebaica, 39 and 527.
Hypoderma sp., 251 and 531.

ILLICIUM VERUM, Its Cultivation and Commerce, 437.
Imperata arundinacea, 250.
Improvements, *see* Agricultural Improvements.
India: Report of the Imperial Economic Botanist for India, 502. Studies in Indian Cottons, 626. The Improvement of Indigo in Bihar, 628. The Cultivation of Poppies for Opium and Seed, 636. The Supply of Milk to Indian Cities, 780. The Indian Jute Industry, 1005. Irrigation Scheme for Sind; The Development of Cotton, 1091. Experiment made at Lyallpur and at Gurdaspur on the use of Sweet Sorghum as a Source of Commercial Sugar, 1119.
Indigo: Report of the Imperial Economic Botanist for India, 1913, 502. The Improvement of Indigo in Bihar, 628.
Indochina: Hevea, 629. Coffee in Tonking, 633. Production of Vanilla, 825. Contribution to the Study of Sericulture, 839. Note on the Selection of Maize in Cambodia, 890. The *Aleurites* of Tonking, 899. The Cultivation of European Fruit Trees in Upper Tonking, 908. The Resin Pine of Tonking, 1013. Report of the Work of the Experiment Stations and Experiment Field of Annam, 1913, 1086. Researches in Sericulture in Cambodia, 1157.
Industries of Animal Products, *see* Meat, Wool, Eggs, Dairying etc.
Industries of Vegetable Products: The Utilisation of the Proteins of Cotton Seed by Man, 475. The Use of "Phosphogelose" in Brazil, 777. *See also* Brewery, Milling, Wine Making etc.
Inga laurina and *I. vera*, 1035.
Institutions, *see* Agricultural Institutions.
Iris Xiphium L., 37.
Irrigation: Sprinkling the Ground in Farming and Gardening, 102. The Present State of Irrigation in Germany, *p.* 295. The Composition of Irrigated and Non-Irrigated Fruits, 247. Eradicating Water Weeds from Irrigating Ditches, 317. Irrigation and Drainage in the United States, 412. The Hindia Barrage on the Euphrates, 414. The Influence of Irrigation and Crop Production on Soil Nitrification, 601. Progress in Irrigation in South Africa, 603. Irrigation in Spain, 981. Overhead Watering Plant, 1090. Irrigation Scheme for Sind, 1091.
Italy: The Study of Agricultural Geology, *p. 19*. Legislative Measures Relating to the Trade in Silkworm Eggs, 298. The Cattle Industry, *p. 598* and *712*. Land Reclaimed in the Province of Ravenna, 413. The Dairy Industry at the Present Time, *p. 842*. Reclamation and Improvements in the Roman Campagna, 773. Reclamation in the Province of Ferrara, *p. 1146*. The Crisis in the Sericulture and the Measures for Averting it, *p. 1263*. The Ombrone Diversion for the Reclamation of the Plain of Grosseto, 878. Animal Husbandry in Sardinia in

Connection with Environment, 927. A Metayer's Family in Chianti, 1167.

JABOTICABA, MYRCIARIA, 1128.
Jambosa jambos, 1035.
Japan: The Imperial Japanese Tohoku University at Sapporo, 93. 93. Legislative Measures Relating to the Trade in Silkworm Eggs, 298. The Silk Industry in Japan during the Reign of the late Emperor Meiji, 455. The Cultivation of Poppies for Opium and Seed, 636.
Jatropha Curcas, 635.
Java: The Cultivation of Teak, 250. Rice Breeding, 617. Tobacco Breeding, 618. The Breeds of Horses of the Sunda Archipelago, 1149. Recent Data on Rubber Plantations, 1117.
Jequirity: On the Anatomy of the Seed of *Abrus precatorius* and of the Seeds Used to Adulterate it. 36.
Jobo, *Spondis lutea*, 1035.
Johore: Recent Data on Rubber Plantations, 1117.
Jute: The Selection of Land for Plantation in the Tropics, 11. The Indian Jute Industry, 1005.

KAGENECKIA OBLIQUA, *p. 1541*.
Kaki, 1125,
Kamerun: Manurial Experiments, 319.
Kapok, 300.
Karakuls: In German South-West Africa, 2.
Karité in the German Colonies, 195.
Kelps: on the Composition of Grain Kelps, 212. The Japanese Seaweed "Tosaka Nori", 1057.
Kentucky Blue Grass, *p. 1387*.
Keteleiria Davidiana, 506.
Khatta, 347.
Khatti, 347.
Kola Nuts in the German Colonies, 195.
Kumquat, *Citrus japonica*, 44.

LANDS, ARABLE: Composition and Agricultural Value of the Arable Lands in the Argentine Republic, *p. 9* and *p. 145*. Study of Hungarian Soils by Means of their Water Solutions, 207. The Effect of Heat on Hawaiian Soils, 315. The Rice Soils of Hawaii, 316. Variation in the Nitrate Content of the Soils in Scania, Sweden, 597. *See also* Soils.
Lantana spp., 1035.
Laurela, *Laurelia aromatica*, *p. 1541*.
Legislative and Administrative Measures: New Legislation on Fertilizers, Feeding Stuffs and Insecticides in the State of New Jersey, 1. Legislative Measures Relating to the Trade in Silkworm Eggs, 298. Technical Commission of Agricultural Meteorology, 299. Legislation for the Protection of Moors in Germany, 698. Encouragement of Olive Growing and Fruit Growing in Tripolitania, 975. *See also* under the various countries.
Leguminosae: The Classification of the Bacteria of Leguminous Plants, 428. In the Argentine Republic, 490. The Resistance of Leguminous Seeds to High Temperatures, 504. Cultivation Experiments with *Vicia striata* in Hungary, 1908-11, 520. In Sweden, 870. In Italian Somaliland, 874. *Vigna Catjang* and *V. unguiculata* in Australia, 1000. *See also* Beans etc.
Lemons: Frost Protection in the Limoneira Lemon Orchards, 346. In Australia, 744.
Lemongrass, 34.
Leucena glauca, 250.
Libocedrus chilensis and *L. tetragona*, *p. 1541*.
Lime: The Degree of Fineness of the Lime used for Dressing Land, 17. The Composition and Agricultural

Value of Carbonate of Lime from Causticising Plant, 419. Research on Vegetable Physiology: III and IV, 503. The Influence of Lime as Quicklime and Carbonate on the Physical Condition of Various Soils, 711. Recent Experience in Farming on Moors, 807. Influence of Lime on Soil Bacteria, 814. Experiments on Flax in Ireland, 1001. The Relative Effect of Lime as Oxide and Carbonate on Certain Soils, 1093.

Lingue, *Persea Lingue*, *p. 1541.*

Lithospermum prostratum, 506.

Litre, *Litrea caustica*, *p. 1541.*

Lleugue, *Prumnopsitys elegans*, *p. 1541.*

Lolium, sp., 341, 433, 540, 815, *p. 1387.*

Lomatia dentata and *L. ferruginea*, *p. 1541.*

Lophira alata and *L. procera*, 236.

Loquat, 744.

Lotus angustissimus, *p. 1387.*

Lucerne: Comparative Histology of Alfalfa and Clovers, 351. The Duration of a Lucerne Ley, 431. In the Argentine Republic, 490. Argentine Lucerne Seed, 623. Physiological Correlations and Climatic Reactions in Alfalfa Breeding, 821. The Value of Turkestan Lucerne, 822. Studies on the Pollination of Lucerne in its Relation to Seed Production, 894. Alfalfa in the United States, 895. Drought-resistant Grasses and Fodder Plants, 999. Alfalfa Hybridization, 1105.

Luma, *Myrceugenia Luma*, *p. 1541.*

Lupin: Feeding Experiments with Lupin and Horse-Chestnut Flakes, 753. Recent Experience in Farming on Moors, 807.

Lupinus arboreus, 506.

MACHILUS GLAUCESCENS, 750.

Machinery and Implements, Agricultural: Experiments with Meyenburg's Motor Cultivator, 52. Threshing with Steam Engine or with Electric Motor, 57. Trials of Agricultural Machines in Sweden, *p. 158.* New Churn, 159. The Electromotor and the Small Farm, 263. Agricultural Motors for the West Indies, 264. The Work of the Windlasses, of the Cables and of the Pulleys in Mechanical Ploughing Outfits, 265. Trial of a Combined Hay Tedder and Side-delivery Rake, 268. Average Results of Threshing Experiments, 270. Milk Separators, 271. Centrifugal Milk Filter, 272. Revolving Churn with Frame, 273. The Shuman Sun Power Plant, 364. Ditch-Excavating Machine, 367. New Machine for Renovating Grass Lands, 368. A New Appliance for Elevating Grain and Granular Goods, 369. Process and Apparatus for the Extraction of Sugarcane Juice 370. Simon's "Star" Sack Cleaner, 371. Stump-Cutting Machine, 458. Trial of Sharple's Milking Machinery, 459. A New Milking Machine, 460. Agricultural Machines Exempted from Customs Duties in Peru, 461. Machines at the General Agricultural Show, Paris 1914, 557. Motor Ploughing Competition of the North Kent Agricultural Association, 558. Fletcher and Becker's Fruit Grader, 560. The Manufacture of Agricultural Machines and Implements in Russia in 1911, 562. Imports and Exports of Agricultural Machines and Implements into and out of Germany in 1913, 564. Rubber-testing Machinery at the Imperial Institute, 661. New Implements used at the Flahult Experiment Farm, Sweden in the Year 1913, 760. Tile-Drain Trench-Digger, 761. Spring-tooth Cultivator, 762. Combined Horse-Hoe and Roll for Beets, 764. Apparatus for Removing Dust

while Threshing, 766. Trial of Machine Ploughing in Rice Fields, 841. Stump Burning to Reclaim "Logged-off Lands", 937. The Garrett Crawley Agrimotor, 938. The Welsh Bracken Cutter, 939. The Articulated Yoke, 940. The Reaper-Thresher, 1040. Swift's New Hay Elevator Fork, 1042. Machine for Pickling Seed Wheat, 1043. Wallace's Portable Milking Machine, 1045. The Influence of Machines and Implements upon the Profitableness of Farms of Different Sizes, 1047. Motor Tillage Machine with Oscillating Spades turning Sideways, 1158. A Latex Hydrometer, 1160. Review of Patents, 59, 162, 374, 565, 768, 941, 1046, 1162.

Madagascar: *Tacca Umbrarum*, 26. Silkworm Rearing, 555. Vanilla, 635 and 825. Rearing Ostriches, 757. Attempts at Breeding the Great White Heron and the Buff-Backed Heron, Cattle-Egret, 933. *Urena lobata* in its Wild State in Madagascar, 1114.

Magnesium, New Investigations, 501.

Maiten, *Maytenus Boaria*, *p. 1541.*

Maize: Selection of Land for Plantation, 11. On the Importance of the Structure of the Ear in the Selection of, 25. In the German Protectorates, 195, 300. A Many-eared Variety of Maize obtained by Selection in Hungary, 225. A Drought-resisting Adaptation in Seedlings of Hopi Maize, 333. A Cultural Experiment with American and African Dent Corn, 334. The Inheritance of Quantitative Characters in Maize, 423. Hungarian Experiments on the Cultivation of an Early Variety of Maize with Soft Grains, 1912-13, 425. Researches on the "Topping" and "Stripping" of Maize in Italy, 426. Loss in Weight of the Ears of Maize on Drying, Hungarian Experiments, 427. In the Argentine Republic, 490. Research on Vegetable Physiology, 503. The Industrial Uses of Maize when Cultivated for Sugar, 631. Note on the Selection of Maize in Cambodia, 890. In Réunion, 976. A Study on the Germinating Power of Seeds, 991. On the Emasculation of Giant Maize in Serbia, 1104.

Male Fern, 1009.

Mandevilea suaveolens, 506.

Manganese: Influence on the Growth of Maize, 503: Action on Plant Growth, 613, 717. Manuring Experiments with Manganese Carbonate in Italy, 984. The Presence in Some Feeding Stuffs, 1021.

Mangels: New Beet-Seed Dibbling Machine (German Patent No. 552166), 157. The New Standards Adopted in Germany for the Trade in Sugar-Beet and Mangel Seeds, 594. Large Scale Field Trials with Mangels, 625. Combined Horse-Hoe and Roll for Beets, 764. Hand Beet-Lifter, 765. Innovation in the Danish Trade in Seeds of Root Crops, 891.

Mango: In Australia, 744. In South America, 745. *Mangifera indica* in Portorico, 1035.

Manihot: A New Method of Tapping Manihot, 30. Tapping Ceara (*Manihot Glaziovii*), 127. Experiments on Tapping Manihot, 241. On the Coagulation of the Latex of *Manihot Glaziowii*, 521. Influence of the Partial Removal of the Bark on the Yield of Latex *Manihot Glaziovii*, 630.

Manila Hemp, *see* Abaca.

Mañin, *Podocarpus andina*, *p. 1541.*

Manioc: Pig Fattening Experiments with Manioc Roots, 154 and 654. Cultivation in Réunion, 976.

Manures: New Legislation on Ferti-

lizers, Feeding Stuffs and Insecticides in the State of New Jersey, 1. On the Decrease of Available Phosphoric Acid in Mixed Fertilizers containing Acid Phosphate and Calcium Cyanamide, 16. The Influence of Manuring upon the Composition of Soils and their Suitableness for Certain Crops, 103. Trial of a Pump for Liquid Manure, 161. Tobacco Stalks as a Fertilizer, 211. On the Composition of Giant Kelps, 212. A New Fertilizer: Molassed Superphosphate (Superphosphatschlempe), 216. The Balance of Fertilizers in the Soil, 318. The Influence of Catalytic Substances on Crop Yields, 320. Production and Consumption of Fertilizers in the World, 605. The Present Position of the Science of Manuring in Germany, *p. 976*. The International Movement of Fertilizers *p. 1101*. Recent Experience in Farming on Moors, 807. Mixed Dressings of Cyanamide and Superphosphate, 418. The Consumption of Artificial Manures in Intensive Agriculture, 568. Experiments with Bacterized Peat, 982. The Duration of the Action of Manures, 1094. The Consumption of Fertilizers in South China, 1097. *See also*, Manure Phosphatics etc.

Manures Catalytic, The Influence of Catalytic Substances on Crop Yields, 320.

Manures, Farmyard: Enrichment of Farmyard Manure by Cake Feeding, 15. Trial of a Pump for Liquid Manure, 161.

Manures, Green: Results obtained at The Tijkemeuh Experiment Garden with various Green Manures, 104. Austrian Experiments in Inoculating Leguminous Crops with Nodule Bacteria, 609. Recent Experience in Farming on Moors, 807.

Manures, Nitrogenous: Comparative Manuring Experiments with Calcium Cyanamide, Nitrogen Lime, Nitrate of Soda and Sulphate of Ammonia on Sandy and Peaty Soils, 105. Nitrogenous Fertilizers Obtainable in the United States, 106. Comparative Effects of Nitrate of Soda and Nitrate of Lime, 607. The Manufacture of Calcium Cyanamide in Dalmatia, 608. Winter Spraying of Fruit Trees with Nitrate of Soda, 638. Influence of Straw on the Utilization of The Organic Nitrogen of Manures, 712. On the Action of Sulphate of Ammonia and Superphosphate of Ammonia in Calcareous Soils, 713. Experiments on the Value of Nitrate of Guanidin and Nitrate of Urea in Comparison with Nitrate of Soda and Nitrate of Ammonia, 815. The Effect of Ammonium Salts on the Tillering of Wheat, 995. *See also* Guano.

Manures, Phosphatic: Investigations on the Availability of Phosphatic Manures, 213. The Solubility of Mineral Phosphates in Citric Acid, 214. Influence of the State of Fineness of Superphosphate and of Basic Slag on their Efficiency, 215. A New Fertilizer: Molassed Superphosphate, 216. Phosphate Beds in Egypt, 321. Talbot Slag, 715. The Solubility of the Various Constituents of Basic Slag, 880. Accumulated Fertility in Grass Land in Consequence of Phosphatic Manuring 1112.

Manures, Potash: The Displacement of Potash in Felspar by Certain Substances Employed as Fertilizers, 99. Manuring Tobacco with Solutions of Potash, 130. A New Manure: Electro-potash, 420. The Manurial Value of Phonolite, 500. Measures for Meeting the Short-

age of Potash Salts in Great Britain, 881. The New Potash Deposits in Spain, 983.

Manuring: In the Tropics, 11. With Solutions of Potash Salts by Spraying the Leaves, Experiments with Tobacco in Hungary, 130. Distribution of Manure in Drills, 218. Manurial Experiments in Palestine 219. In the German Colonies, 319. In China, 416, 1097. In East Prussia, 606. Manuring of Malting Barley, 621, 622. In Germany. *p. 976.* Manures on Moors, 807, 982. The Duration of the Action, 1094.

Maqui, 754.

Market Gardening *see* Gardening.

Marrubium vulgare, 1009.

Marsh Mallow, 1009.

Martinique: Production of Vanilla, 825.

Mayotte: Production of Vanilla, 825. *Maytenus Boaria* and *M. magellanica p. 1541.*

Meadows and Pastures: Phosphoric Substances in Meadow Hay, 222. Grassland in Britain: Types and their Formation, 340. New Machine for Renovating Grass Land, 368. Silesian Grazing Farms, 376. Two Years' Results from the Cooperative Pasture at Coswig, in Anhalt, Germany, 377. In the Argentine Republic, 490. Observations on the Laying-down and Care of Permanent Pastures, 731. In Sweden, 870. The Grass and Clover Seed Industry in New Zealand, *p. 1385.* Accumulated Fertility in Grass Land in Consequence of Phosphatic Manuring, 1112. Experiments on the Grazing of Woodlands, 1133. Pasture and Grain Crops for Hogs in the Pacific Northwest, 1153.

Meadow Fescue, *p. 1387.*

Meadow Saffron, 1009.

Meadowsweet, 1009.

Meats: An American View on the Beef Cattle Situation, 49. Carcass Tests conducted on Lincoln and Mangalicza Pigs in Hungary, 360. The Amount of Bone in Animals for the Slaughterhouse, 284. Cold Storage in Argentine, 490. Meat Trades of Germany, 668. Beef Production in the United States, 679. Presence of Tubercle Bacilli in Flesh, 751. In Sweden, 870. In New South Wales, 1027. The Odessa Cattle and Meat Supply, 1062. A Comparaison between the Fat Stock and the Carcasses Exhibited at the Smithfield Show, 1913, 1177.

Medicinal Plants: Cultivation of in Hungary, *p. 26.* On the Anatomy of the Seed of *Abrus precatorius*, Jequirity, and of Seed Used to Adulterate it, 36. The Breeding of Medicinal Plants, 117. Experiments in Growing Medicinal Plants at Korneuburg in 1913, 827. Medicinal Plants in Tunis, 905. Composition of Essence of *Artemisia* collected in Italy, 1006. The Cultivation and Collection of Medicinal Plants in England, 1009. Medicinal Plants in South Africa, 1123.

Melì, *Myrceugenia multiflora, p. 1541.*

Melissa officinalis, p. 26, 1009.

Memia vaccinia, 635.

Menyanthes trifoliata, 1009.

Mesopotamia: The Hindia Barrage on the Euphrates, 414.

Mesquite, 1127.

Mesua ferrea, 235.

Meteorology: Present Organization of Agricultural Meteorology in Sweden, *p. 6.* Temperature Coefficients in Plant Geography and Climatology, 97. Distribution of Drought, 199. On Seasons and Crops in the East of England, 200. Correlation between Meteorological Conditions and Crops in the East of Scotland, 20. The Compo-

sition of Rainwater Collected in the Hebrides and Ireland, 202. Rainfall as a Determinant of Soil Moisture, 203. The Institution of a Technical Commission of Agricultural Meteorology at the "Direction Générale des Eaux et Forêts" in France, 299. The Frequency of Low Temperatures in the Sudan and its Effect on the Cotton Crop, 304. Rainfall and Spring Wheat, 305. Relation of Precipitation to Tree Growth, 306. Recent Studies of Snow in the United States, 307. Is the Earth Drying Up? 407. The Economic Value of Tropical Rains 408. Blooming Periods and Yields of Fruit in Relation to Minimum Temperatures, 439. Determination of Air Temperatures, 493. Chemical Composition of Rain in South Africa 494. An Improved Cog Psychrometer, 808. Physiological Correlations and Climatic Reactions in Alfalfa Breeding, 821. The Effect of Climatic Conditions on the Rate of Growth of Date Palms, 978. The Climate of Ethiopia, 1087.

Microbiology, *see* Bacteriology and Soil Organisms.

Milk: Researches made at Alnarp, 64. Determination of the Amount of Water added to Milk based on the Degree of Acidity, 65. The Composition of Ewes' Milk Sold in Hungary, 67. A Study of the Udder Flora of Cows, 259. The Decomposition of Milk Proteins by Lactic Ferments, 281. Titration of Milk with Alcohol at Different Degrees of Concentration 380. The Bactericidal Properties of Milk at Low Temperatures, 381. On the Schardinger and other Reactions of the Ferments of Goats' Milk, 470. Determination of the Viscosity of Milk as a Means of Detecting the Addition of Water, 569. Biorized Milk, 570. The Effect of Certain Dairy Operations upon the Germ Content of Milk, 571. The Origin of Some of the Streptococci Found in Milk, 572. The Influence of the Fat Content of Milk upon the Rapidity of Coagulation, 676. Experiments with the Biorisator, 781. Preserving Milk Samples for Examination, 852. Ratio between Specific Gravity and Fat and Dry Matter in Cow's Milk, 948. Bacteriological Enquiry on Sterile Milk Sold in Brussels, 1058. The Influence of Foot-and-Mouth Disease on the Composition of Milk and Butter, 1060. The Cause of Acidity in Fresh Milk of Cows and a Method for the Determination of Acidity, 1172. Ability of Streptococci to Survive Pasteurization, 1173.

Milka, 349.

Mill: Trial of a Roller Mill, 58.

Millet: The Value and Use of Millet Malt, 675. The Estimation of Hydrocyanic Acid in Feeding-Stuffs and its Occurrence in Millet and Guinea Corn, 1101.

Milling Industry: The Baking Qualities of Flour as influenced by Certain Chemical Substances, Milling By-products and Germination of the Wheat, 383. Preliminary Investigation into the Variation in the Physical Composition of Wheat Milling Offals, 473. The Reduced Gluten Content of Flour, 778. The Variation of Gluten in Wheat Flour and Grain, 1109.

Mimosa dealbata, 506.

Moca or Cabbage Tree, *Andira jamaicensis*, 1035.

Moors: Comparative Manuring Experiments with Calcium Cyanamide, Nitrogen lime, Nitrate of Soda and Sulphate of Ammonia, 105. Recent Experience and Progress in Moor-Cultivation in Ger-

many, *p. 313*. The Humus of Acid and Alkaline Peats, 311. The Solution and Precipitation of Iron in the Formation of Iron Pan, 312. The Bacterial Treatment of Peat, 410. Legislation for the Protection of Moors in Germany, 698. Chemical Composition of Moor Hay Provoking Excessive Licking in Cattle, 708. The Utilization of Peat in Italy, 714. *Beckmannia erucaeformis* Host., a New Grass for Moor Meadows, 732. Recent Experience in Farming on Moors, 807. A New Way of Utilizing the Energy of Peat Beds, 813. Experience with Motor Ploughs in the Cultivation of Moor Soil, 842. Investigations into the Profitableness of Fen Cultivation, 848. Experiments with Bacterized Peat, 982. Recent Inoculation Experiments on Virgin Sphagnum-Moor Soils, with Various Cultures of Bacteria of Leguminosae, 1096. Some Accessory Factors in Plant Growth and Nutrition, 1102.

Motor Cultivation: Experiments with Meyenburg's Motor Cultivator, 52. Motor Plough Trials of the German Agricultural Society at Klein-Wanzleben, 53. Maillet's Motor Tilling Machine, 54. Trial of Motor Ploughs, 266. New Rotary Tilling Machine: The "Motoculteur", 365. The Motor Plough Trials at Litowitz and at Komotau Hagensdorf, 662. A Self-Steering Farm Motor, 663. Trial of Machine Ploughing in Rice Fields, 841. Experience with Motor Ploughs in the Cultivation of Moor Soil, 842. The Garrett-Crawley Agrimotor, 938. Report on the International Competition of Motor Tillage Machines at Chaouat, Tunis, in 1914, 1039.

Mucuna utilis = *Stizolobium utile*, 1146.

Mugwort, 1009.

Mulberry, Leaves Preserved in Cold Storage, 758. In Turkestan, 829. Studies on the Chemical Composition of Mulberry trees in Japan, 907. Studies on the Mulberry Leaf, 1099.

Mules: *see* Asses and Mules.

Mullein, 1009.

Murta murtella, 745.

Musa Sapientum, *see* Bananas.

Musa textilis, *see* Abaca.

Mutation, *see* Selection, and Botany, Agricultural.

Myrceugenia apiculata and *M.* sp. *p. 1541*.

Myrsine africana, 506.

NANDINA DOMESTICA, 506.

Netherlands: The Cultivation of Poppies for Opium and Seed, 636. Agricultural Education, *p. 971*. Improvement of Waste, Land, 812.

New Caledonia: Live Stock, 545. Ostrich-Farming, 657. Production of Vanilla, 825.

New Guinea: The Development of Agriculture, 195 and 300. Manurial Experiments, 319.

New South Wales: New Varieties of Wheat and Oats, 994. Some Data on the Animal Products and the Control of Rabbits, 1027.

New Zealand: Plant Breeding and Selection, 226. The Grass and Clover Seed Industry, *p. 1385*. The Wool Clip in the Year 1913-14, 1063.

Nipa fruticans, 738.

Nirre, *Nothofagus Pumilio*, *p. 1541*.

Nitragin, 609.

Nitrates, *see* Manures.

Nitrification *see* Bacteriology and Soil Organisms.

Nitrogen: Effect of the Nature and of the Water Content of Soils upon their Nitrogen Content, 98. On the Assimilation by Plants of Nitrogen in the Form of Tyrosine, Leucine and Witte's Peptone, 111, 887. Movement of Nitrates in the Soil,

205. The Nature and Amount of the Fluctuations in Nitrate Content of Arable Soils, 314. Variation in the Nitrate Content of the Soils in Scania, Sweden, 597.
Nodon's Electrical Process, 1159.
Norway, The Breeds of Horses, 834.
Nothofagus betuloides and *N.* sp., *p. 1541.*
Nutmeg, 11.

Oak-tree: In Hungary, *p. 1542.* The Manchurian Timber Industry, 1015. *Quercus insignis*, 1131.
Oats: In the Argentine Republic, 490. Field Trials with Spring Wheat and Oats in Germany in 1909-10, 727. Experiments on the Value of Nitrate of Guanidin and Nitrate of Urea in Comparison with Nitrate of Soda and Nitrate of Ammonia, 815. In Sweden, 870. The Action of Various Electrolytes on the Grains of *Avena sativa*, 988. A Study on the Germinating Power of Seeds, 991. New Varieties of Wheat and Oats in New South Wales, 994.
Ocynum pilosum, 904.
Oilcrops: Selection of Land for Plantation in the Tropics, 11. Gru-Gru Palm, 28. Some New or Little-known Oil Seeds and Oils 235. Some New Tropical Oil Seeds, 236. *Acrocomia Sclerocarpa* and Gru-Gru Oil, 237. Baobab Fruit and Seeds from the East African Protectorate, 238. Contribution to the Study of *Hibiscus cannabinus*, 239. Oils in the Seeds of *Dumoria Heckeli* and *Baillonella toxisperma* Pierre, 627. In the Italian Somaliland, 874. The *Aleurites* of Tonking, 899. The Seeds of *Trichilia* from the Nigerian Sudan, 1116. *See* Olive etc.
Oils various: Gru-Gru Palm Kernel Oil, 28, 237. Palm oil in the German Colonies, 195, 300. Some New or Little-Known Oil Seeds and Oils 235. Some New Tropical Oil Seeds 236. Baobab Oil, 238. *Hibiscus cannabinus*, 239. Utilization of Para Rubber Seed, 240.
Olive: In Tunisia, 749. Methods of Propagation of Olives, 896. Olive Growing in Syria, 897. Olive Growing in the District of Tizi-Ouzou, Algeria, 898. Encouragement of Olive Growing in Tripolitania, 975. Studies on the Extraction of Olive Oil, 1055.
Opium *see* Poppy.
Oranges: A trial of Orange Stocks at Peshawar, 347. The Chemical Composition of Florida Oranges, 442. Production in Australia, 744.
Oreodaphne californica, 506.
Ornamental Plants: Hibiscus in Hawaii, 344. Pruning Hardy Shrubs, 1011.
Ostriches: In German South-West Africa 2, In New Caledonia, 657. Rearing Ostriches in Madagascar, 757.

Packing and Transport of Agricultural Products: A New Cattle Cart, 372. Arrangements for the Carriage of Agricultural Produce by Rail in France especially on the Paris-Lyon-Méditerranée Co's System, 680. *See also* Trade Import and Export.
Palma real, *Roystonea boringuena*, 1035.
Palm oil *see* Elaeis and Oil Crops.
Palms: *Acrocomia sclerocarpa* and Gru-gru Palm, 28, 237. Dum Palm, 39. Problems Concerning the Utilization of the Dum Palm in Italian Erythrea, 526. Palms Indigenous in Cuba, 883.
Panicum bulbosum and *P. prolutum*, Drought-resistant Grasses, 999.
Papaya in Hawaii, 642. In South America, 745.

Paprika Pepper: The Cultivation of Paprika Pepper in America, 343. Field Cultivation of Capsicum in Meglena, Hellenic Macedonia, 527.
Paraguay, Cotton, 1004.
Paspalum dilatatum, *p. 1387*.
Passion fruit, 744, 745.
Pastures, *see* Meadows.
Palo blanco or Varital, *Drypetes glauca*, 1035.
Patents *see* Machinery.
Peaches: in Spain *p. 836*. In Australia, 744. In South America 745.
Peanut: The Selection of Land for Plantation in the Tropics, 11. In the German Colonies, 195, 300. In the Argentine Republic, 490. Some Data on Peanut Butter, 1056.
Pears: Present State in Greece, 132. The Flowering of Pears, 249. In Spain, *p. 836*. In Australia, 744. The Influence of Chemical Manures on the Keeping Qualities of Pears, 912.
Peas: Variation in the Hereditary Value of Characters in Individual Flowers of *Pisum sativum*, 326. On Differential Mortality with Respect to Seed Weight Occurring in Field Cultures of *Pisum sativum*, 327. Field Trials of Vegetable: Four Years' Trials of Green Peas, 1909 to 1912, 820.
Pelargonium, 33.
Pelù, *Sophora tetraptera*, *p. 1541*.
Pentadesma butyracea and *P. leucantha*, 235, 236.
Perfume Crops: The Cultivation of the Rose Geranium and its Present and Future Economic Conditions, 33. Note on a Lemon-Grass from Fiji, 34. A Perfume Plant from West Africa, *Popowia Capea*, 35. The Forcing of Spanish Iris, 37. *Cymbopogon coloratus* Oil from Fiji, 637. In Réunion, 976. Irises Used in Scent-Making, 1121.
Persea Lingue, *p. 1541*.
Persia: The Cultivation of Poppies for Opium and Seed, 636. Sericultural Products, 759.
Peru Situation of Guano, 107. Agricultural Machines Exempted from Customs Duties, 461. Fruit, 745. Prohibition of Collection of Guano in the Ballestas Islands, 1095.
Peta, *Myrceugenia planipes*, *p. 1541*.
Peucedanum graveolens, 1009.
Peumo, *Cryptocarya Peumus*, *p. 1541*.
Phalaris cruciformis, 723.
Phaseolus acutifolius var. *latifolius*, 231.
Phasianus torquatus, 155.
Philippines: Indian Cattle, 1030.
Phytin, Studies, 448.
Phytolacca decandra, 1009.
Pig Keeping: In Germany, *p. 30*. In German South-West Africa, 2. Studies of the Endogenous Metabolism of the Pig as Modified by Various Factors, 41. Colour Inheritance in Swine, 44. Pig Fattening Experiments with Manioc Roots, 154. A Note on Sex Determination, 352. Pig Feeding Experiments, 362. Protective Inoculations against Swine Fever in Hungary *p. 707*. In Argentine Republic, 490. Swinepox in Young Pigs, 536. In Morocco, 544. Fattening Pigs on Cassava, 654. Investigations into the Metabolism and the Potential Energy of Foods in Growings Pigs, 756. The Swine Raising Industry in Canada *p. 1154*. In Sweden 870. Rearing Pigs in Movable Pens, 1031. Comparative Experiments on Pigs in the State Subventioned Breeding Districts of Denmark, 1032. On Ovariotomy in Sows; with Observations on the Mammary Glands and the Internal Genital Organs, 1140. Pasture and Grain Crops for Hogs in the Pacific Northwest, 1153. Pig Feeding Experiments in Germany, 1154.
Pigeons: Studies on Inheritance, He-

reditary Relations of the Principal Colours, 926.

Pili nuts, 911.

Pimpinella Anisum, *p. 26*, 1009.

Pine: in Hungary, *p. 1391*. The Resin Pine of Tonking, 1013. In Chile *p. 1535*.

Pine Apple in the Philippines, 438. In Australia, 744.

Piñon, *Araucaria imbricata*, *p. 1541*.

Pistachios in Greece, 132.

Pitra, *Myrceugenia multiflora*, *p. 1541*.

Plant Breeding: On the Importance of the Structure of the Ear in the Selection of Maize, 25. The Inheritance of Blossom Colour in Beans (*Phaseolus*), 115. Seed Selection of Egyptian Cotton in Arizona, 116. Characters of the Grain in Varieties of Hungarian Pedigree Wheat and their Hereditary Transmission, 223. Increase of the Productivity of Hungarian Wheat by Means of Selection, 224. A Many-eared Variety of Maize Obtained by Selection in Hungary, 225. Plant Breeding and Selection in New Zealand, 226. Selection of Plant Breeding in Denmark, *p. 419*. Royal Hungarian Institute for Plant Breeding, 323. Studies on Variation and Selection, 324. The Preservation of Pollen, 325. Variation in the Hereditary Value of Characters in Individual Flowers of *Pisum sativum*, 326. On Differential Mortality with Respect to Seed Weight Occurring in Field Cultures of *Pisum sativum*, 327. A Genetic Analysis of the Changes Produced by Selection in Experiments with Tobacco 328. The Institute for Agricultural Botany and the Institute for Seed Selection in Bavaria, 403. Experiments on the Selection of Spring Wheats from Autumn Wheat in Hungary, 421. Hybrids between *Triticum monococcum* and other Species of Wheat, 422. The Inheritance of Quantitative Characters in Maize 423. Methods and Results of the Selection of Flax in Russia, 511. On the Appearance of Sterile "Dwarfs" in *Humulus Lupulus*, 512. A Preliminary Note on the Genetics of *Fragaria*, 513. Root-Nodosities of Crosses between Swedes and Turnips, *p. 833*. Breeding Experiments which Show that Hybridisation and Mutation are Independent Phenomena, 615. A Case of Correlation in Wheat, 616. Rice Breeding in Java 617. Tobacco Breeding, in Java. 618. Inheritance of the Capacity for Production, 719. International Factors connected with the Physiology of Germination in Wheat Grains, 720. Xenia in *Phaseolus* Crosses, 721. The Inheritance of Germination Energy, Germination Capacity and Sensitiveness to Light in Seeds of *Poa pratensis*, 722. Physiological Correlations and Climatic Reactions in Alfalfa Breeding 821. Thirteen Years of Wheat Selection, 889. Note on the Selection of Maize in Cambodia, 890. Selection of Cocksfoot, *Dactilys glomerata* in New Zealand, 992. Mutation in Egyptian Cotton, 993. Lax- and Dense-Eared Wheats, 1103. On the Emasculation of Giant Maize in Serbia, 1104. Alfalfa Hybridization, 1105.

Ploughs: Trial of a Double-Furrow Turn-Wrest Plough with Lever Adjustment, 267. Ditch-Excavating Machine, 367. Automatic Lifter for Balance Ploughs, 659. *See also*, Motor Cultivation.

Plum, in North America, 135. In Spain, *p. 836*. In Australia, 744.

Poa pratensis and *P. trivialis*, 722, 999 and *p. 1387*.

Podocarpus andina and *P. chilina*, *p.* 1541.

Pollination: The Pollination of Fruit Trees in Relation to Productiveness and Planting, 133. The Pollination of Coconut, 248.

Polygonum Lapathifolium, 1144.

Pomorosa, rose apple, *Jambosa jambos*, 1035.

Pomegranates in Greece, 132.

Popowia Capea, 35.

Poppies: The Cultivation of Poppies for Opium and Seed in Various Countries. 636.

Porlieria hygrometrica, *p.* 1541.

Porto Rico: Studies on Acid Soils, 100. The Red Clay Soil of, 495. Bee-Keeping, 1035.

Potato: Variations in Osmotic Pressure in Potatoes during Storage 114. Mutation of Tuberous Species of *Solanum* produced under Cultivation, 232. The Prevention of Degeneration in Potatoes, 336. The Effect of the Weight of Seed Potatoes Upon the Succeeding Crop, 337. The Amylometer, a New Apparatus for Estimating the Starch Content of Potatoes, 338. A Society for Promoting the Cultivation and Economic Utilization of Potatoes 339. Selected Strains of Hungarian Potatoes, and their Productivity, 429. Manurial Experiments with Potatoes in Hungary, 1913, 430. A New Process of Preparing Potatoes for Acid Ensilage with Pure Cultures of Lactic Bacteria, 474. In Argentine Republic, 490. "Germania" Potato Esiccator with Oil Heating, 561. Utilization of Potato 645. Potato-drying Works in the German Empire, 674. Formation of Aerial Tubers in Potatoes, 729. New Blight-proof Variety of Potatoes, 996.

Poultry: Production and Export in Tripolitania, 45. Reciprocal Crosses between Reeves' Pheasant and the Common Ringneck Pheasant Producing Unlike Hybrids, 155. Fowl House for 80 or 100 Fowls, 163. A Further Study of Size Inheritance in Ducks, with Observations on the Sex Ratio of Hybrid Birds, 353. Rudimentary Parthenogenesis in the Golden Pheasant, 354. Early Identification of Good Hens, 363. Twelve Months Poultry Laying Competition. 452. Some Physiological Observations Regarding Plumage Pattern, 453. The Odour of the Flesh of the Coot, 454. The Influence of the Male Parent on the Character of the Egg-shells in Fowls, 655. Seaweed for Packing Birds, 656. Poultry-Farming in Canada, 658. Chicken Rearing, 837. Experiments on Egg Laying in Different Breeds of Poultry, 838. In Sweden 870. Preliminary Notes on the Heredity of Certain Characters in a Cross between Silky and Yokohama Fowls, 925. Winter Egg Records in Ireland, 932. Report on the Poultry Industry in South Australia, *p.* 1400. Attempts at Breeding the Great White Heron and the Buff-backed Heron in Madagascar, 933. *Eleusine indica*, Crowfoot Grass, in Queensland, Dangerous to Stock, 1016. Poultry Conditions in Indiana, 1033. Egg-Laying Competitions in Australia, 1034. Research on the Transformation of Energy in the Domestic Fowl, 1142.

Press Binder: Straw Press Binder with Groups of Arms working together, 1041.

Prosopis Siliquastrum and *P. Tamarugo*, *p.* 1541.

Prumnopitys elegans, 506 and *p.* 1541.

Psamma arenaria, 812.

Psidium Guajava, 745.

Psychrometer: An Improved Cog Psychrometer, 808.
Pueraria Thunbergiana, 432.
Pump: Trial of a Pump for Liquid Manure, 161. Pump for Watering Cattle worked by the Animals themselves, 767.
Punica Granatum var. *Legrellei*, 506.
Pyrites: Sulphur and Pyrites Used as Manure, 18.

QUEBRACHO in Argentina *p. 10.*
Quercus suber and *Q.* Sp., 506. In Hungary, *p. 1391.* Manchurian Timber Industry, 1015. *Q. pedunculata*, *p. 1535. Q. insignis*, 1131.
Quillai, *Quillaja saponaria*, *p. 1541.*

RABBIT: Some Data on the Animal Products and the Control in New South Wales, 1913, 1027.
Radal, *Lomatia dentata*, *p. 1541.*
Radium: The Use of Radium as a Means of Forcing Plants, 221. Influence of Radioactive Emanations on Vegetation, 322. The Influence of Radioactive Emanation on Yeasts and Alcoholic Fermentation, 1053.
Rain: The Composition of Rain-water Collected in the Hebrides and in Ireland, 202. Rainfall as a Determinant of Soil Moisture, 203. The Relation between an Abundant Rainfall and the Production of Coffee, 243. Rainfall and Spring Wheat, 305. Relation of Precipitation to Tree Growth, 306. The Economic Value of Tropical Rains, 408. Chemical Composition of Rain in South Africa, 494.
Rauli, *Nothophagus procera*, *p. 1541.*
Reana luxurians, 518.
Reaper-Thresher, 1040.
Refrigeration: Trial of a Refrigerating Installation, 160. Mulberry Leaves Preserved in Cold Storage, 758. Refrigeration in Wine Making 945.
Rehmannia angulata, 506.
Réunion: Production of Vanilla, 825.
Rhizophora mucronata, 436.
Rhododendron campylocarpum, 506.
Rice: The Influence of Salts Common in Alkali Soils upon the Growth of the Rice Plant, 13. The Classification of Cultivated Rice, 118. The Gases of Swamp Soils; their Composition and Relationship to the Growth of the Crop, 119. The Rice Soils in Hawaii, 316. The Physiology of the Germination of Rice, 335. The Determination of the Quality of Starch in Rice Grains 611. Rice Breeding in Java, 617. Feeding Experiments with Rice Gluten Food, 646. Trial of Machine Ploughing in Rice Fields, 841. A New Esiccator for Paddy, 843. Senegal Perennial Rice as Forage, 998. On the Botanical Origin of Cultivated Rices, 1111.
Root Crops: *Tacca umbrarum*, a Starch-producing Plant in Madagascar, 26. Mutations of Tuberous Species of *Solanum* produced under Cultivation, 232. *Dalembertia populifolia*: an Edible Plant in Mexico, 730. In the Italian Somaliland, 874.
Roystonea boringuena, 1035.
Roble de Magellanes, *Nothofagus betuloides*, *p. 1541.*
Rubber: Selection of Land for Plantation in the Tropics, 11. The Rubber Crisis, 29. An Improvement in the Method of Preparing Brazilian Rubber, 128. The Standardisation of Plantation Rubber, 129. In the German Colonies, 195 and 300. On the Coagulation of the Latex of *Manihot Glaziowii*, 521. The Coagulation of the Latex of *Hevea* and its Bearing on the Strength of Rubber, 522. *Hevea* in Cochinchina, 629. Influence of the Partial Removal of the Bark

on the Yields of Latex in *Manihot Glaziovii* 630. Rubber-testing Machinery at the Imperial Institute, 661. Tapping Trials with *Funtumia elastica* in the Belgian Congo, 737. In the Italian Somaliland, 870. Recent Data on Rubber Plantations, 1117. Tapping and Tapping Systems, 1118. A Latex Hydrometer, 1160. The Influence of Nitrogen Compounds on the Vulcanization of Rubber, 1171. *See also* Hevea, Manihot etc.

Rue, 1009.

Rumania: Vine Growing and Wine Making, 1012.

Rural Economy: The Profitableness of Present Day Sheep Keeping in Germany, especially in Comparison with Cattle and Pig Keeping, *p. 30*. Some Profitable and Unprofitable Farms in New Hampshire, 60. The Private Economic Conditions of Moravian Peasant Farmers 61. Farming Conditions in the Department of Puy-de-Dôme, France, 62. The Profitableness of Milk Farms, 63. Farming on the Share System and Monograph of a Large Estate worked on this System during the Period from 1891 to 1910, 164. Situation and Problems of Live Stock Breeding and Keeping in Modern Intensive Agriculture, 165. Intermediate Valuation of "not Marketable" Produce of the Farm in Agricultural Book-keeping, 166. Cause of Difference of Income in Two Pure-bred Dairy Cattle Farms, 167. Sugar-Beet Farming in Austria-Hungary, 168. Cost of Rearing a Calf, 169. Observations on the Practice and Profitableness of Bee-keeping in Switzerland, 170. Foundation of a Land Valuation Office by the Swiss Peasants' Association, 171. The Significance of the Fluctuation in the Price of Cereals for the Profitableness of the Moravian Peasant Farming, 276. The Amortization of the Capital in Buildings in Swiss Agriculture, 277. Proposals for Reform of the Valuation System based on the Inherent Capacity of the Soil ("Bonitierungstaxe"), 278. Form of Agricultural Agreement for the Cultivation of Sugar-cane, *p. 428*. A Farm Management Survey of Three Representative Areas in Indiana, Illinois and Iowa, 375. Silesian Grazing Farms, 376. Two Years' Results from the Cooperative Pasture at Coswig, Germany, 377. The Cost of Milk Production in the Countries of Kent and Surrey, 378. The Depopulation of the Country, 379. Influence of the Distance from the Market on Farming in Fifty Moravian Farms, 465. Types of Agricultural Holdings in Northern Tripoli, 466. The Recent Valuation of Land Other than Building Land in France, 467. Cost of Production, Marketing and Exporting Wheat in Canada, 468. The Cost of Raising a Dairy Cow, 469. The Economic Importance of Beet Growing, 567. The Consumption of Artificial Manures in Intensive Agriculture, 568. The Economic Limit of Sugar-Beet Growing, 665. Work and Wages of Foreign Labourers in Prussia 666. Cost of Production of Milk and Beef, 667. The German Imperial Commission of 1912-13 on the Cattle and Meat Trades, 668. The Statistical Method and its Value for the Economics of Farming, 769. Principles of Exact Investigations in Agriculture, 770. Giving Farm Labourers a Personal Interest in their Work, 771. Piece-Work in German Farming, 772. Reclamation and Improvements in the Roman Campagna, 773. Statistical Research on Farm

Produce, 845. The Position of Non-Breeding Dairy Farms in Modern Agriculture, 846. Investigations into the Profitableness of Fen Cultivation, 848. The Cost of Establishing an Orchard in Tasmania, 849. Book-keeping Statistics on the Profitableness of Bee-Keeping in Switzerland in 1912-13, 943. Scale of Points for Judging a Mixed Dairy Farm, 1026. The Influence of Machines and Implements upon the Profitableness of Farms of Different Sizes, 1047. The Agricultural Labourers Required on Farms under 100 Hectares (247 Acres) in Extent, 1048. Influence of Economic Conditions on the Methods of Farming, 1049. The Influence of the Prices of Agricultural Produce upon the Farming Conditions in Switzerland, 1050. On the Selection of Crop Rotations, 1164. Comparative Cost of Food for a Heifer, Stall-fed or at Grass, up to her First Calving, 1166. A Metayer's Family in Chianti (Tuscany), 1167. *See also* Book-keeping.

Russia: Farming on the Share System and Monograph of a Large Estate worked on this System during the Period from 1891 to 1910, 164. The Manufacture of Agricultural Machines and Implements, 562. The Odessa Cattle and Meat Supply, 1062.

Ruta graveolens, 1009.

Rye-Grass in India, 341. The Food Value of, 540.

SACK: Simon's "Star" Sack Cleaner, 371.

Salts Common, *see* Sodium Chloride.

Salvia dichroa, 506.

Sambucus nigra, 1009.

Samoa: Some Data on the Agriculture of, 300. Manurial Experiments, 319.

Sandy Soils: Comparative Manuring Experiments with Calcium Cyanamide, Nitrogen Lime, Nitrate of Soda and Sulfate of Ammonia, 105. Quantitative Mineralogical Analysis, 208. *Suaeda fruticosa* for the Fixation of Shingle Beaches, 245. In Mongolia, 329. Improvement in the Netherlands, 812.

Schools of Agriculture *see* Education.

Screw Bean, *Prosopis pubescens*, 1127.

Scrophularia nodosa, 1009.

Seeds: Studies on Differential Mortality in the Germination of Bean Seeds, 110. Seed Control in Austria, *p. 299*. The Institute for Agricultural Botany and the Institute for Seed Selection in Bavaria, 403. The Farmers' Seed-Growers' Cooperative Association in Wisconsin, 514. Report on the Work of the State Seed-testing Station in Denmark in the Year 1912-13, 515. Impurities in Seeds in Victoria, Australia, 516. The New Standards adopted in Germany for the Trade in Sugar-Beet and Mangel Seeds, 594. Action of Thorium on Seeds, 614. Impurities in Seeds, 619 and 724. Argentine Lucerne Seed, 623. Researches on the Germination Capacity and on the Capacity of the Plumule to Emerge from the Soil, 723. Innovation in the Danish Trade in Seeds of Root Crops, 891. The Longevity of Some Common Seeds, 892. Studies on the Pollination of Lucerne in its Relation to Seed Production, 894. The Grass and Clover Seed Industry in New Zealand, *p. 1385*. A Study on the Germinating Power of Seeds, 991. Seed Experiments in Flax in Ireland, 1001. Machine for Pickling Seed Wheat, 1043. Tree Growth and Seed, 1106. The Controlling Influence of Carbon Dioxide in the Maturation, Dormancy and Germination of Seeds, 1107.

Seeder *see* Drills.
Seedless Pomeloes in Siam, 441 and 1126.
Selection of Plants *see* Plants Breeding.
Senegal: Cattle-Breeding and Dealing, 652.
Sericulture: On the Zygotic Constitution of Dominant and Recessive Whites in the Silkworm, *Bombyx mori* L., 147. Legislative Measures Relating to the Trade in Silkworm Eggs. Enquiry made by the International Institute of Agriculture, 298. The Silk Industry in Japan during the Reign of the Late Emperor Meiji, 455. Comparison between Silk Cocoons produced by feeding the Worms on Standard or Dwarf Mulberry leaves, 456. In Madagascar, 555. In Kien Chang, 556. Mulberry Leaves Preserved in Cold Storage, 758. Sericultural Products in Persia, 759. Contribution to the Study of Sericulture in Indo-China, 839. The Crisis in Italian Sericulture and the Measures for Averting It, *p. 1263*. Economical Methods of Rearing Silkworms, 1036. Report on Sericultural Experiments in France, 1037. The Silk Weaving Industry of Amarapura, Burma, 1156. Researches in Cambodia, 1157.
Servia: Agriculture, 90. The Cultivation of Poppies for Opium and Seed, 636.
Sesam: In the German Colonies, 195. The Toxicity of Soil to Cabbage after a Crop of Sesame, 210.
Shade Plants: *Dolichos*, 906. Inga, 1035.
Shaftal, *Trifolium resupinatum*, 341.
Sheep Keeping: The Profitableness of Present-day Sheep Keeping in Germany, especially in Comparison with Cattle and Pig keeping, *p. 30*. African Sheep, Wool Sheep, Persian Sheep in German South-West Africa, 2. Malignant Oedema in Sheep 40. Stock Production in Tripolitania, 45. The Zackel Sheep in Bosnia and Herzegovina, 153. In Italian Somaliland, 357. The Distribution of the Wild Sheep in Relation to Watersheds, 361. Abortion in Sheep, 446. In Argentine Republic, 490. Morocco Sheep and their Products, 551. Development and Prospects of Sheep Breeding for Wool in German South-West Africa, 552. The Shower-Bath System of Sheep Dipping, 566. Karakul Sheep in the Argentine, 653. Formation of a German Sheep-breeders' Union, 835. In Sweden, 870. Breeding of Karakul Sheep in the United States, 929. The Sheep Maggot Fly (*Calliphora rufifacies*) and its Parasite, 1017. Origin of Karakul Sheep, 1152.
Sheep's Fescue, *p. 1387*.
Shows: 9, 95, 197, 302, 405, 491, 595, 702.
Shuman Sun Power Plant, 364.
Sick Soils Culture Experiments, 14.
Silky Oak, 824.
Sisal Hemp, Selection of Land for Plantation in the Tropics, 11. In the German Colonies, 195, 300. *Agave Sisalana* and *Fourcroya gigantea* at Cape Verde, 1115.
Sisyrinchium striatum, 506.
Skins *see* Hides.
Snow: Recent Studies of Snow in the United States, 307.
Sodium Chloride: Effects on Cultivation of Rice, 13. As a Manure; New Investigations Carried out in Sweden 417.
Soil: The Study of Agricultural Geology in Italy, *p. 19*. The Selection of Land for Plantation in the Tropics, 11. The Soil Solution and the Mineral Constituents of the Soil, 12. The Influence of Salts Common in Alkali Soils upon the Growth of the Rice Plant, 13. Culture Experiments

on Sick Soils, 14. Effect of the Nature and of the Water Content of Soils upon their Nitrogen Content, 98. The Displacement of Potash in Felspar by Certain Substances Employed as Fertilizers, 99. Studies on Acid Soils of Porto Rico, 100. Bright Virginia Tobacco Soils, 101. Selective Adsorption by Soils, 204. Movement of Nitrates in the Soil, 205. The Aluminium Reduction Method as Applied to the Determination of Nitrates in "Alkali" Soils, 206. Study of Hungarian Soils by Means of their Water Solutions, 207. Quantitative Mineralogical Analysis of Sandy Soil, 208. The Toxicity of Soil to Cabbage after a Crop of Sesame, 210. On a New Method of Measuring the Capillary Lift of Soils, 308. On Osmosis in Soils: The Efficiency of the Soil Constituents as Semipermeable Membranes, 309. Estimation of the Surface of Soils, 310. The Humus of Acid and Alkaline Peats, 311. The Solution and Precipitation of Iron in the Formation of Iron Pan, 312. Ferrous Iron in Soils, 313. The Nature and Amount of the Fluctuations in Nitrate Content of Arable Soils, 314. The Effect of Heat on Hawaiian Soils, 315. The Presence of some Benzene Derivatives in Soils, 409. The Question of Soil Maps, 411. Manures and Manuring: Sodium Chloride as a Manure; New Investigations carried out in Sweden, 417. Separation of Soil Particles according to their Specific Gravity and the Relations between Plants and Soils, 704. Rocks and Soils in their Relation to the Nutrition of Plants, 705. A Further Case of Soil Sterility in the Dutch East Indies, 706. Relations of Certain Higher Plants to the Formation of Nitrate in Soils, 707. The Influence of Lime as Quicklime and Carbonate on the Physical Condition of Various Soils, 711. Distribution of Soil Particles, 809. The Red Clay Soil of Porto Rico, 495. Humus in California Soils, 599. Soils with a Mineral Acidity, 600, 980. The Influence of Irrigation and Crop Production on Soil Nitrification, 601. The Action of Manganese in Soils, 613. A New Method of Determining the Density and Porosity of Soil and Rocks, 876. A New Method for the Determination of Soil Acidity, 877. The Influence of Sulphur on Soil Acidity, 979. The Influence of the Osmotic Pressure of the Soil Solution on the Growth of Spring Wheat, 987. The Estimation of Phosphates in Soil Extracts, 1088. Experiments in Tilling the Soil by Means of Explosives, 1092.

Soils, Acid: Studies on Acid Soil of Porto Rico, 100. Soils with a Mineral Acidity, 600. Acid Mineral Soils, 980.

Soils, Alkali: The Influence of Salts Common in Alkali Soils upon the Growth of the Rice Plant, 13. The Aluminium Reduction Method as Applied to the Determination of Nitrates in "Alkali" Soils, 206. A Further Case of Soil Sterility in the Dutch East Indies, 706.

Solanum Dulcamara, 1009.

Somaliland: Stock Breeding in Southern Italian Somaliland, 257. The Experiment Farm at Genale, 874.

Sophora tetraptera, p. 1541.

Sorghum: The Estimation of Hydrocyanic Acid in Feeding-Stuffs and its Occurrence in Millet and Guinea Corn, 1101. The Use of Sweet Sorghum as a Source of Commercial Sugar or as Fodder, 1119. Poisoning by *Sorghum halepense*, 1135.

Sorindea oleosa, 236.

Southernwood, 1009.
Sowing: In Sweden, 870. Experiments with Autumn Sown Crops in Ontario in 1911, 1110.
Spain: Legislative Measures Relating to the Trade in Silkworm Eggs, 298. Present State of Fruit Growing, *p. 836*. The Cultivation of the Sugar-cane in the South of Spain, 900. Irrigation, 981. The New Potash Deposits, 983. Market Gardening, 1124. Spanish Wines, 1169.
Spirea Ulmaria, 1009.
Spondias, 745, 1035.
Sprayer: Randell's Dry Sprayer, 1044.
Spring-tooth Harrows, 56.
Stable: Cheap Stable Walls, 463.
Starch: *Tacca umbrarum*, a Starch-producing Plant in Madagascar, 26. The "Amylometer": a New Apparatus for Estimating the Starch Content of Potatoes, 338. Composition of Various Starches, 610. The Determination of the Quality of Starch in Rice Grains, 611.
Stations, Agricultural and Experimental: Recent Work of the Royal Hungarian Station of Biology and Animal Nutrition, *p. 432*. Experiments with Plots of Different Sizes, 699. The Work of the Buitenzorg Botanic Gardens for 1913, 700. The Experiment Farm at Genale, Italian Somaliland, 874. Reorganization of the Experimental Garden at Hamma, near Algiers, 875. The Royal Colonial Garden at Palermo, 977. Report of the Work of the Experiment Stations and Experiment Fields of Annam, 1913, 1086.
Storing of Agricultural Products: Variations in Osmotic Pressure in Potatoes during Storage, 114. The Respiration of Fruits and Growing Plant Tissues in Certain Gases, with Reference to Ventilation and Fruit Storage, 477. The Successful Storage of Californian Table Grapes, 478. Agricultural Storehouses in Bavaria, 784. The Preparation of Ensilage, 1143. Experiments on Storing Swedes during the Winter in Denmark, 1180. *See also*, Ensilage, Refrigeration, etc.
Straw: Influence of Straw on the Utilization of the Organic Nitrogen of Manures, 712. The Value of Different Kinds of Straw as Fodder, 832. Straw Press Binder with Two Pincer-like Groups of Arms working together, 1041.
Strawberries: A Preliminary Note on the Genetics of *Fragaria*, 513. Warm Baths for Forcing Strawberries, 528. The Influence of Soil and Manures on the Yield, Chemical Composition, Size and Quality of Strawberries, 828.
Stump Burning to Reclaim "Logged-off Lands", 937.
Sty: Pig-sty with Device for Protecting and Warming Sucking Pigs, 942.
Suaeda fruticosa, 245.
Suckling Clover, *p. 1387*.
Sudan: The Frequency of Low Temperatures in the Sudan and its Effects on the Cotton Crop, 304. The Seeds of *Trichilia* from the Nigerian Sudan, 1116.
Sugar Beets: New Beet Seed Dibbling Machine, 157. Sugar Beet Farming in Austria-Hungary, 168. Distribution of Manure in Drills: Results obtained in Experiments on Barley, and Sugar Beets at Hatvan, Hungary, in 1912, 218. Selection in Denmark, *p. 419*. The Cultivation of Sugar Beets in the Island of S. Miguel in the Azores, 434. The Economic Importance of Beet Growing, 567. The New Standards adopted in Germany for the Trade in Sugar Beet and Mangel Seeds, 594. The Economic Limit of Sugar Beet Growing, 665. Analysis of Su-

gar Beets, 739. Sugar-Beet Experiments in Ireland, 901. Connection between Available Space, Weight and Sugar Content of Beets and Mangolds, 823. Innovation in the Danish Trade in Seeds of Root-crops, 891.

Sugar Cane: The Stomatal Characteristics of Sugar Cane, 24. The Experimental Error in Sampling Sugar Cane, 125. Cultivation of, in the Argentine Republic, *p. 424* and 490. In the German Protectorates, 300. Process and Apparatus for the Extraction of Sugar Cane Juice, 370. Comparative Water Absorption of Sugar Cane Plants when Suffering from Sereh Disease, 632. Cultivation of the Sugar Cane in the South of Spain, 900. Agriculture in Réunion, 976.

Sugar crops: The Industrial Uses of Maize when Cultivated for Sugar, 631. The Nipa Palm as a Commercial Source of Sugar, 738. The Use of Sweet Sorghum as a Source of Commercial Sugar or as Fodder, 1119. *See also* Sugar Cane, Sugar Beets.

Sugar Industry: The Use of Hydrosulphites in the Manufacture of Beet Sugar, 70. Process and Apparatus for the Extraction of Sugar-cane Juice, 370.

Sulphur and Pyrites used as Manure, 18. Influence of Sulphur, 503. The Influence of Sulphur on Soil Acidity, 979.

Sumatra: Recent Data on Rubber Plantations, 1117.

Sun: The Shuman Sun Power Plant, 364.

Sweden: Present Organization of Agricultural Meteorology, *p. 6*. Trials of Agricultural Machines, *p. 158*. Variation in the Nitrate Content of the Soils in Scania, 597. Breeding Ardenne Horses, 754. Agriculture, 870. Work of the Entomological Section of the Swedish Central Agricultural Experiment Station, during the Years 1907-14, *p. 1410*. The Control of Plant Diseases, *p. 1546*.

Sweet Potato as a Cover Crop in Coconut Plantations, 120.

Switzerland: Observations on the Practice and Profitableness of Bee-Keeping, 170. Foundation of a Land Valuation Office by the Swiss Peasants' Association, 171. The Amortization of the Capital in Buildings in Swiss Agriculture, 277. Book-Keeping Statistics on the Profitableness of Bee-Keeping, 943. Fish Breeding in Switzerland in 1913, 1038. The Influence of the Prices of Agricultural Produce upon the Farming Conditions, 1050.

Sylviculture, *see* Forestry.

Symphytum officinale, 1009.

Symphonia laevis and *S. Louveli*, 1133.

Syrmaticus reevesi, 155.

TACCA UMBRARUM, 26.

Tahiti: Production of Vanilla, 825.

Tamarugo, *Prosopis Tamarugo*, *p. 1541*.

Tanacetum vulgare, 1009.

Tangerines in Australia, 744.

Tanning and Colouring Matters: Selection of Lands for Plantation in the Tropics, 11. The Most Important Tannin Yielding Plants of German East Africa, 436. Recognition of Tanning and Colouring Matters by Means of the "Mulhouse Band", 525. In the Italian Somaliland, 870. *See Acacia, Quercus*, etc.

Tansy, 1009.

Taraxacum officinale, 1009.

Tavolo, 26.

Tea: Selection, 244. "Autumnal Flavour" of Tea, 524. Manuring Experiments at Peradeniya, 1120.

Teck, 250.

Temu, *Myrceugenia Temu*, *p. 1541*.

Teñin, *Weimannia trichosperma*, *p. 1541*.
Tepú, *Tepualia stipularis*, *p. 1541*.
Teucrium fruticans, 506.
Teucrium Scorodonia, 1009.
Therminalia Chebula, 436.
Thorn Apple, 1009.
Tiaca, *Caldeluvia paniculata*, *p. 1541*.
Tillage and Methods of Cultivation: Growing Crops in Western Nebraska, 415. Mechanical Tillage Experiments at Grignon, France, 457. Technical Precautions Necessary in the Electrification of Crops, 604. Tillage Experiments in Algeria, 709. Trials of the Zehetmayr Method of Drilling Cereals carried out in Sweden 710. The Effect of One Crop upon Another, 716. Influence of Economic Conditions on the Methods of Farming, 1049. Experiments in Tilling the Soil by Means of Explosives, 1092.
Timothy, *p.* 1387.
Tobacco: The Selection of Land for Plantation in the Tropics, 11. In the French Colonies, 31. Turkish Tobacco in the Cape Province, 32. Bright Virginia Tobacco Soils, 101. Manuring Tobacco by Spraying the Leaves with Solutions of Potash Salts: Experiments in Hungary, 130. Tobacco Stalks as a Fertilizer, 211. Purchase of Tobacco made by the State Monopoly in Hungary in 1912, 242. A Genetic Analysis of the Changes produced by Selection in Experiments with Tobacco, 328. In Argentine Republic 490. Report of the Imperial Economic Botanist for India 1913, 502. Tobacco Breeding in Java, 618. Manurial Experiments with Tobacco, 741. Nicotine in the By-products of the Cultivation of Tobacco, 826. In the Italian Somaliland, 874. In Réunion, 976. Two Crosses of Strong Tobacco in Italy, 1007. The Chemical Composition of the Tobacco Plant in its Various Stages of Growth, 1008. The Effect of Shading on the Transpiration and Assimilation of the Tobacco Plant in Cuba, 1122.
Togo: The Development of Agriculture, 195 and 300. Manurial Experiments, 319.
Tosaka mori 1057.
Tractor: Rausome's Steam Traction Engines, 262. The "Detroit" Rein-Steerage Gasoline Tractor, 366.
Trade, Imports and Exports of Agricultural Products: Stock-Breeding in Tripolitania. The Export of Stock and of the Products of the Stock-Breeding Industry, 45. Sulphate of Copper: Production, Trade and Consumption, 108. In the German Colonies, 195. Seed Control in Austria and its Effects upon Agriculture and Trade, *p. 299*. Legislative Measures Relating to the Trade in Silkworm Eggs, 298. The Cultivation and Commerce of Aniseed, 437. Cost of Production, Marketing and Exporting Wheat in Canada, 468. The New Standards adopted in Germany for the Trade in Sugar-Beet and Mangel Seeds, 594. Cattle-Breeding and Dealing in Senegal, 652. The German Imperial Commission of 1912-13 on the Cattle and Meat Trades, 668. Arrangement for the Carriage of Agricultural Produce by Rail in France, especially on the Paris-Lyon-Méditerranée Co's System, 680. Agricultural Storehouses in Bavaria, 784. In Sweden, 870. Some Data on the Animal Products and the Control of Rabbits in New South Wales, 1027.
Trichilia, 1116.
Tripolitania: Stock-Breeding, 45, Report of the Government Commission for the Study of the Natural and Agricultural conditions of Tripoli,

401. Types of Agricultural Holdings in Northern Tripoli, 466. Formation of an Agricultural Office for Tripoli, 701. Encouragement of Olive Growing and Fruit Growing, 975.
Tripsacum fasciculatum, 733.
Tumbo, 745.
Tunis : The Cultivation of Olives, 749. Medicinal Plants, 905.
Turkestan : The Cultivation of Cotton, 342. Fruit and Vine Growing, 829.
Turkeys, in New South Wales, 1127.
Tussilago Farfara, 1009.

Ulmo, muermo, *Eucryphia cordifolia*, *p. 1541.*
Ultraviolet Rays, The Modifications produced in the Anthrax Bacterium by Means of, 1136.
United States of America : New Legislation on Fertilizers, Feeding Stuffs and Insecticides in the State of New Jersey, 1. Some Profitable and Unprofitable Farms in New Hampshire, 60. Nitrogenous Fertilizers Obtainable in the United States, 106. Experiments in Bulb Growing, 131. A Farm Management Survey of Three Representative Areas in Indiana, Illinois and Iowa, 375. Irrigation and Drainage, 412. Growing Crops in Western Nebraska, 415. The Cost of Raising a Dairy Cow, 469. The Farmers' Seed-Growers' Cooperative Association in Wisconsin, 514. Humus in California Soils, 599. Colt-breeding in Pennsylvania, 647. Raising and Fattening Beef Calves in Alabama, 651. A Review of Beef Production in the United States, 679. The Angora Goat, 836. Thirteen Years of Wheat Selection, 889. The Propagation of the Date Palm, 909. Date Palms from Irak, 910. New Fruits on North American Markets, 911. The Breeding of Karakul Sheep, 929. Hemp Production, 1003. Poultry Conditions in Indiana, 1033. Economical Cattle Feeding in the Corn Belt, 1151. Origin of Karakul Sheep, 1152. Pasture and Grain Crops for Hogs in the Pacific Northwest, 1153. Bold Concrete Dam, 1163.
Urea : Experiments on the Value of Nitrate of Guanidin and Nitrate of Urea in comparison with Nitrate of Soda and Nitrate of Ammonia, 815.
Urena lobata, 1114.
Uruguay : Present State of Cattle Breeding, *p.* 607.

Valeriana officinalis, 1009.
Vanilla : The Selection of Lands for Plantation, 11. Production in Madagascar, 635. In the French Colonies, 825. In Réunion, 976.
Verbascum Thapsus, 1009.
Vicia dasycarpa, 999. *V. striata*, 520.
Vigna Catjang, 104, 882, 1000.
Vine Growing : A New Graft-Hybrid, 136. The Nursery of American Vines in The Tremiti Isles (Adriatic). Its History and the Results obtained, 246. The Successful Storage of Californian Table Grapes, 478. Cultivation in Argentine Republic, 490. Recent Work of the Royal Hungarian Central Ampelological Institute at Budapest, 529. The Growth of the Roots of the Vine and its Importance in the Manuring and Cultivation of the Soil of Vineyards, 530. Protection of Vines against Spring Frost, 531. Shallow Cultivations in Vineyards, 640. Influence of American Vine Stocks on the Quality of the Wine Produced in Champagne, France, 641. Influence of Different American Vine Stocks upon the Quantity and Quality of the Wines, 746. Experiments in Growing Vine Hybrids in Styria, 747. Self and Cross-Fertilization Experiments with Vines, 748.

Vine Growing in Central Asia, 829. Hybrid Direct-Bearers in the Côtes-du-Rhône District, France, in 1913, 914. Vine Growing and Vine Making in Rumania, 1012.
Viticulture, *see* Vine Growing.

Walnuts: In Greece 132. In Australia, 744. In Central Asia, 829.
Waste Water: Purification and Disposal of Waste Water from Dairies, 677.
Water, Requirement of Plants in the Great Plains, 20.
Water-Raising Device, 1161.
Wax: Imports and Exports in Sweden, 870. Collection and Exportation of the Wax of Wild Bees in the African Colonies, 936.
Weimannia trichosperma, *p. 1541.*
Western Wolths, *p. 1387.*
Wheat: Characters of the Grain in Varieties of Hungarian Pedigree Wheat and their Hereditary Transmission, 223. Increase of the Productivity of Hungarian Wheat by Means of Selection, 224. Cultivation Experiments with Loose-Eared varieties of Winter Wheat, 227. Studies on the Stem Anatomy of Wheat and its Bearing on Classification, 228. Present State of Plant Breeding in Denmark, *p. 419.* Rainfall and Spring Wheat, 305. Environmental Influences on the Physical and Chemical Characteristics of Wheat, 331. Experiments on the Selection of Spring Wheat from Autumn Wheat in Hungary, 421. Hybrids between *Triticum monoccocum* and other Species of Wheat, 422. Determination of the Varieties of *Triticum monococcum* L., 424. Cost of Production, Marketing and Exporting Wheat in Canada, 468. Preliminary Investigation into the Variation in the Physical Composition of Wheat Milling Offals, 473. In the Argentine Republic, 490. Report of the Imperial Economic Botanist for India 1913, 502. A Case of Correlation in Wheat, 616. Effect of Low Winter Temperature during 1913-1914 on Wheat in the Ardennes, 620. International Factors connected with the Physiology of Germination in Wheat Grains, 720. Researches on the Ears of Wheat and of Spelt for the Precise Characterisation of Varieties, 725. Six Years' Trials of Winter Wheats in Denmark (1907-1912), 726. Field Trials with Spring Wheat and Oats in Germany in 1909-10, 727. The Resistance of Wheats to Winter, 818. In Sweden 870. Thirteen Years of Wheat Selection, 889. Influence of External Physical Agents on the Germination of Wheat, 893. Investigations into Factors affecting the Handling of Wheat Hay, including a Study of its Digestibility, 922. Influence of the Osmotic Pressure of the Soil Solution on the Growth of Spring Wheat, 987. A Study on the Germinating Power of Seeds, 991. New Varieties of Wheat and Oats in New South Wales, 994. The Effect of Ammonium Salts on the Tillering of Wheat, 995. Machine for Pickling Seed Wheat, 1043. Fractional Analysis of Wheat, 1098. Lax and Dense Eared Wheats, 1103. Studies upon Influences affecting the Protein Content of Wheat, 1108. The Variation of Gluten in Wheat Flour and Grain, 1109. Experiments with Autumn Sown Crops in Ontario in 1911, 1110.
Wine-making: Recent Work of the Royal Hungarian Central Ampelological Institute at Budapest, 529. Improvement of Damaged Wines and Spirits, 573. Results obtained by the Distribution of Pure Hun-

garian Yeast Cultures in 1912, 670. Hybrid Wines at the Toulouse Exhibition, 1914, 671. Influence of Chloroform and of Oil of Mustard on the Alcoholic Fermentation of Grape-Must, 672. The Electric Field in the Maturation of Wine, 775. Refrigeration and Aeration of New Wines as a Means of Hastening their Maturity, 850. Wine Making without Refrigeration in Warm Countries, 944. Refrigeration in Wine Making, 945. A New Method of Making Wine and of Utilizing the Pomace, 946. Determination of the Tartaric Acid in Wines by Physico-chemical Volumetric Analysis, 947. Vinification by means of Ferments other than Wine Yeasts, 1051. Physico-chemical Volumetric Estimation of Potash and Magnesia and its Application to Wines, 1052. The Origin, Quantity and Signification of Lactic Acid in certain Italian Wines, 1168. Spanish Wines, 1169. The Wines of Istria, 1170.

Wood: Fireproofing of Wood, 462. West Indian Boxwood, 1132. The Rapid Drying and Preservation of Wood by Nodon's Electrical Process, 1159.

Wool: Production and Export in Tripolitania, 45. Development and Prospects of Sheep Breeding for Wool in German South-West Africa, 552. Industry in Sweden 870. Industry in New South Wales, 1027. The Wool Clip in Australasia in the Year 1913-14, 1063. "Quality" in Wool, 1178.

Wormwood, 1009.

X-Rays, Influence on Vegetation, 990.

Xylocarpus sp, 436.

Yarrow, 1009.

Zebu in the Philippines, 1030.

Zinc: Influence on the Growth of Maize, 503, The Error in Water Culture Experiments due to the Presence of Traces of Zinc in Glass, 508.

Zizyphus vulgaris, 506.

B) INDEX OF AUTHORS.

Aaronsohn, A., 897.
Abderhalden, 382.
Abramson, Erik, 754.
Adam, J., 652.
Adamovic, L., 90.
Aereboe, Friedrich, 1049.
Aereboe, Friedrich and Brinkmann, Franz, 278.
Ageton, C. N., *see* Gile, P. L.
Aielli-Donnarumma, 1007.
Akemine, M., 335.
Åkerberg, B., 760.
Albert, F., *page 1535*.
Alessandrini, Giulio, 92.
Alessandrini, G. and Scala, A., 91.
Alexandrowitch J., *see* Rümker, v. K.
Allison, Le Roy, W., 937.
Althansen, L., 511.
Alvarez, Juan Angel, *page 607*.
Amadeo, T., *page 287*.
Amman, P. and Vuillet, J., 1116.
Anderson, P. T., 639.
Anderson, R. J., 257, 448.
Andouard, P., *see* Gouin, A.
André, G., 99.
Annett, H. E., 1119.
Arkell, H. S., *page 1255*.
Arndt, *see* Fingerling, Bretsch Lösche; and Fingerling, Köhler, Reinhardt, Bretsch and Dietrich.
Arvay, Ernst, 1043.
Astruc, A., *see* Jadin F.
Auf dem Thie, Hermann, 63.
Augé-Laribé Michel, 62.
Ayers S., Henry and Johnson, William T. Jr., 1173.
Bailey, P. L. and Engledow, F. L., 1173.
Bailhache, G., *see* Rivière, G.
Baldrati, I., 526.
Balkányi, Béla, 402.
Balland, 778.
Ballantyne, A. B., 439.
Ballard, W. S. and Volck, W. H., 638.
Ballenegger, 207.
Baltel, G., 528.
Bamber, M. Kelway, 1120, 1129.
Bánn, Jenö, 536.
Barbieri, N. A., 1098.
Bardy, P. and Ries, M., 634.
Bariola, Rosa, 36.
Barnstein, F., 1023.
Barritt, N. W., 522.
Barsacq, José, 829.
Baudrexel, August *see* Völtz, Wilhelm and Deutschland, Arnold.
Beaumont, P., 664.
Beccari, Odoardo, 735.
Beckett, E., 1011.
Bedford, duc de, and Pickering, S. U., 716, 809.
Beesley, R. M., 598.
Beger, C., 1020.
Bennet, C. Morris and Cooper Morton, O., 469.
Berry James B., 1106.
Berkhout, A. E., *see* Ledelver, F.
Bernard, P., 665.
Bernard, Ch., and von Leersum, P., 244.
Bernardi, G., 426.
Berteau, A., 525.
Berthault, Pierre, 673.

The figures in italics refer to the number of the page, the others to the number of the abstract.

Berthold, Hans, 2.
Bertrand and Sartory, A., 718.
Besana, C., *page 842.*
Bhaduri Kshitibhusan, 904.
Bierry, B. and Fandard, L., 538.
Billinghurst, G. E., 107.
Biro, Gusztáv, 67.
Bishop, C. M., 1015.
Bizzel, James A., *see* Lyon, T. Lyttleton.
Blackshaw, G. N., 101.
Blaha, Sigismund, 454.
Blair, H., *see* Collins, S. H.
Blair, T. A., 305.
Blanck, E., 705.
Blaringhem, L. and Miège, F., 228.
Blin, Henri, 1121.
Bodenstab, Hermann, 436.
Böggild, Bernhard, *page 167.*
Bohutinsky, G., 822.
Bois, D. and Diguet, L., 730.
Bolin, P., 417.
Bond, C. J., 146.
Bonhote, J. Lewis, 925.
Boodle, L. A., 477.
Boodle, L. A., *see* Sprague, T. A.
Bordas, F. and de Raczkowski, Sig., 1060.
Bordiga, O., *page 1263.*
Borel, M., 633.
Boring, A. M., *see* Pearl, R.
Borzì, A., 977.
Bosworth, A. W., *see* Van Slyke, L. L.
Bottomley, W. B., 410, 1102.
Boulanger, H., 783.
Bousigues, 680.
Boyd Mossom, M., 648.
Boyer, L., 631.
Boyle, H. H., 441, 1126.
Brackett, R. N., 16.
Brand, C. J. *see* Sherman, W. A. and Taylor, Fred.
Brannon, M. A., 114.
Breakwell, E., 997, 999.
Breda de Haan, J. Van, 617.
Bremekamp, C. E. B., 632.
Brenchley, W. E., *see* Hall, A. D. and Underwood, L. M.
Brétignère, L., 52.
Bretsch, *see* Fingerling, Lösche and Arndt, *see* Köhler, Reinhardt, Arndt and Dietrich.
Brichet, J., 132.
Bridges, C. B., 148.
Briggs Lyman, J. and Schantz, H. L., 20.
Brinkmann, Franz, *see* Aereboe, Friedrich.
Brinkmann, Theodor, 846.
Brooks William, P., 895.
Brouet, G., *see* Demolon, A.
Brownlee, G., 949.
Brown, W. Robertson, 431, 347.
Bruce, W., 258.
Bruchholtz, K. G., 549.
Brüne, Fr., *see* Tacke, Br.
Brünnich, J. G., 1130.
Brünnich J. C. und Smith F., 1019.
Bude, Albert, 166.
Bufalini, D., 1170.
Buffa, Pietro, 758.
Bui-Quang-Chieu, 839.
Burg, 173.
Burgess, P. S., 206.
Burmeister Harald, 150.
Burnett, E. A., *see* Snyder, W. P. and Burr, W. W.
Burr, W. W., *see* Snyder, W. P. and Burnett, E. A.
Butz, 377.

Campbell, C., 896.
Capus, G., 408.
Carleton, A. E., 1097.
Carpiaux, E., *see* Grégoire, A.
Carrère, 1013.
Cassuto, L., 204.
Castle, W. E., 355.
Cayla, M. V., 128.
Cerny, J., 271.
Charabot, Eug., and Gatin, C. L., 33.
Chateauclos, R., 607.
Chaussé, P., 252.
Chavan, P., *see* Dusserre, C. and Tschumy, L.
Chevalier, A., 437, 902, 908.

Chavau, P., *see* Dusserre, C. and Tschumy, L.
Chevalier, A., 437, 902, 908.
Chevalier, Aug., and Roehrich Olivier, 1111.
Chittenden, F. G., 249.
Chuard, E. and Mellet, R., 826.
Chubbuck, Levi, 931.
Church, J. E., 307.
Claude, and Rouillard, 139.
Clausen, 169.
Claus, *see* Givesius.
Clawson, A. B., *see* Marsh, C. Dwight.
Cochel, W. A. and Severson, B. C., 647.
Cockayne, A. H., *page 1385.*
Cole Leon, J., 926.
Colle, J., *see* Denaiffe, M.
Collin, G. N., 333.
Collins, S. H. and Blair, H., 543.
Colver, C. W., *see* Jones, J. S.
Compain, E., *see* Miège, E.
Cooper, Evelyn Ashley, 871.
Cooper, Morton O. *see* Bennet, C. Morris.
Cornell, Ralph., 909.
Cotton, A. D., 1057.
Cotton, J. S., and Ward W. F., 1151.
Couderc, 640.
Coupan, G., 563.
Coupé, H., *see* Miège, Em.
Crabtree J., 499.
Craib W. G., 906.
Craig, R. A. and Whiting, R. A., 920.
Crampton, C. B., *see* Smith, W. G.
Cranfield, H. T., 473.
Crivelli, E., 108.
Cuddie, D., 1059.
Cuénod, A., 905.
Currie, James N., 950.
Cvijié, 527.

Dafert, F. W., 621.
Dafert, O., 715.
Dahlberg, A. C., *see* Rogers, L. A.
Daikuhara S., 980.
Daish, A. J., *see* Davis, W. A.
D'Alverny A., 915.
Daniel Jean, 721.
Daniel, L., 136.
Danthony, E., *see* Vermorel, V.
Dantin Ch., 1159.
Darabzett, D. B., *see* Warth, F. G.
Darsie, Marvin L., Elliott, Charlotte and Peirce George, J., 991.
Davis, W. A. and Daish, A. J., 22, 1100.
Dean William Harper, 1090.
De Castro, L., *see* Eredia.
Deschambre, P., 545.
De Condé, F., 659.
De Cordemoy, H. Jacob, 649.
De Flacourt, Martin, 890, 1157.
Degel, R., 274.
De Gironcourt, G., 39.
De Jong, A. W. K. 700, 736.
Dekobba, M., 656.
De la Rosa, Fernandez G., 981, 1169.
Delbavie, J., *see* Labarde, J.
Demolon, A. and Brouet, G., 217.
Demoussy, E., *see* Maquenne. L.
Denaiffe, 620.
Denaiffe, M. and Colle, J., 429.
De Rossi, Gino, 381.
Desmoulins, Amédée und Villard, Victor, 914.
Deutschland, Arnold, *see* Völtz, Wilhelm and Baudrexel, August.
Devraigne, George, 1086.
De Vries, O., 741, 742.
Dienes Ludwig, 140.
Dietrich, *see* Fingerling, Köhler, Reinhardt, Bretsch and Arndt.
Diguet, L., *see* Bois, D.
D'Ippolito, G., 984.
Dixon, H. M., *see* Thomson, E. H.
Dodge, Lawrence G., *see* Robertson, Fred.
Doherty, T. K., 38.
Doria, Mario, 927.
Dornic, Daier and Vignerot, 677.
Dorph-Petersen, 515.
Dorsett, P. H., 131.
Doyne, H. C., *see* Morison, C. G. T.
Drouhard, E., 1114.
Duborg, A. C., 851.
Duboux, Marcel, *see* Dutoit, Paul.
Dunlop, W. R., 24.

Dupré, H. A., *see* Lynde, C. J.
Durham Herbert, E., 1092.
Dusserre, C., Chavan P. and Tschumy, L., 222.
Dutoit, Paul and Duboux, Marcel, 947, 1052.
Duval, Ch., 766.

East, E. M. and Hayes, H. K., 328.
East, E. M., *see* Emerson, R. A.
Eastham, Alfred, 892.
Eaton, B. J., 1160.
Ebbinghaus, H., 47.
Eckenbrecher, C., von, 819.
Edler, W., 594.
Edwards, C. W., 1030.
Ehrlich, 40.
Elliott, Charlotte, *see* Darsie Marvin, L. and Peirce George J.
Elofson A., 731.
Emerson R. A. and East E. M., 423.
Engels O., 711.
Engledow, F. L., *see* Bailey, P. L.
Eppes, E. B. and Plefs, C. E., 432.
Eredia, Filippo, 198.
Eredia, and De Castro, L., 1087.
Eriksson, J., *page 546.*
Ezden-Tempski, K., von, 772.
Evans, Alice C., 1174.
Evans, L. A., 849.
Evans Morgan, W., *see* Piper, C. V., Mc Kee, Roland and Morse, W. J.
Ewald, *see* Hansen, Reisch and Lilienthal.

Fabrici, Fános, 253.
Faes, H. und Porchet, F., 746.
Fandard, L., *see* Bierry, B.
Fauchère, A., 26, 523, 555, 635.
Feilitzen, von Hj. 708, 807.
Feilitzen, von and Nyström, 1096.
Fiebiger, 254.
Fingerling, Bretsch, Lösche and Arndt, 141.
Fingerling, Köhler, Reinhardt, Bretsch Arndt and Dietrich, 756.
Fink, E., *see* Meyer, G.
Fischer, G., 58, 268.
Flaksperger, C., 424.
Fleischmann, Rezsö, 25.
Fleischmann, W., 948.
Flint, E. M., Hart, E. B., Hastings, E. G. and Evans, Alice C., 1174.
Foitik, Ch., 729.
Fornaci, C., 1035.
Fortier, V., 658.
Foth, G., 474, 776.
Fournier, J., 627.
Frank, 368.
Frank, O. 149.
Frateur, J. L. and Nolhant, A., 154.
Fraysse, A., 657.
Freckmann, W. and Schotta, 848.
Freeman, G. F., 231, 821.
Freeman, W. G., 740.
Fridon, 284.
Froggat, Walter W., 1017.
Furlong, J. R., 1101.

Gard, M., 748.
Gardner, V. R., 345.
Garino Canina, E., 888.
Garino, Canina E., *see* Mensio, R.
Garrad, G. H. and Mackintosh, J., 378.
Gassner, G. and Grimme, C., 330.
Gaszen, Károly, 234.
Gates ,R. R., 615.
Gatin, C. L., *see* Charabot, Eug.
Gavin, W., 46.
Gauvry, E., 944.
Geake, A., 471.
Genieser, E., 450.
Gerhartz, Heinrich, 1142.
Gerlach, Otto, 1048.
Gerö, Vilmos, 65.
Gerrard ,P. N., 4.
Gerstung, F. *page 713.*
Gibbs, H. D., *see* Pratt, D. S., Thurlow, L. W. and Williams, R. R.
Gile, P. L. and Ageton, C. N., 495.
Girard, 629.
Gisseleire, A., 737.
Giuliani, Renzo, 359.
Giurel, G., *see* Jacquemin, G.
Givesius and Claus, 723.
Gläser, Hans, 251.
Gläser, *see* Schöttler.

Goffinet, F., 91.
Goldschmidt Harald, 755.
Golf, 552.
Goodnight, Ch., 648.
Gorini, C., 541, 923, 1134, 1145.
Gorjatschkin, W., 269.
Goubau, R., 510.
Gouin, André and Andouard, P., 256, 654.
Goujon, *see* Marchadier.
Graaff, W. C. De and Schaap, A., 281.
Grabner, Emile, 224, 225, 323, 421, 429.
Grabtree, J., 495.
Graham, R. J., 118.
Gratz, O. and Vas, K., 1175.
Gray Dan, T. and Ward, W. F., 651.
Green, A. W., 226.
Green, H. H., *see* Löhnis, F.
Grégoire, A. and Carpiaux, E., 540.
Gregory, J. W., 407.
Greiner, Wilh., 369.
Grimme, C., *see* Gassner, G.
Grossmann, 666.
Grotz, O. and Sanzyi, St., 782.
Guffroy, Ch., 279.
Guilhelm, 933.
Guillochon, Verry, Tournieroux and Robinet, 749.
Guinchard, 870.
Gulbertson, J. D., 346.
Güngerich, 1165.
Guthrie, F. R., 1025.
Gyárfás, J., 520.

Hadfield, J. W., 1000.
Hadley Philip, B., 1139.
Hagedoorn, A. L. und Hagedoorn, A. S., 321.
Haeutle, Chr., 751.
Hagenstein, 270.
Haglund, E., 174.
Hagmann, 568.
Hall, A. D., 15, 1094.
Hall, A. D., Brenchley, W. E. and Underwood, L. M., 12.
Hall, Louis D., *see* Mumford Herbert, W.
Hamberg, H. E., *page 6*.
Hammond, John, 1141.
Hammond, J., *see* Mackenzie, K. J. J. and Marshall, F. H. A.
Hanisch, Heinrich, 1002.
Hanley, J. A., 310, 311.
Hanne, R., 5.
Hansen, Reisch, Ewald and Lilienthal, 753.
Hansen, Reisch E. and Schweiger, M., 646.
Hansson, N., 42, 1024.
Harding, H. A. and Wilson, J. K., 259.
Harding, H. A., Ruehle, J. K., 571.
Harnoth, *see* Hoffmann, M.
Harris, J. A., 110, 327.
Harrison, W. H. and Subramania Aiyer, P. A., 119.
Hart, A., 1034.
Hart, E. B., 1174.
Hasenbäumer, J., *see* König, J. and Krönig, R.
Haskins, H. D., 211.
Hasselbring, Heinrich, 1122.
Hastings, E. G., 1174.
Hattrick, J. Montgomerie, 744.
Hayes, H. K., *see* East. E. M.
Headden, W. P., 1089.
Hebert, A., 236.
Heckel, Edouard, 1104.
Heckel, E. and Verne, C., 232.
Hedrick, U. P., 444.
Hegedoorn, A. L. and Mrs, A. C., 324.
Heinrichs, 767.
Heller, L. L., 836.
Hellmann, G., 493.
Helweg, H. M., 891.
Helweg, L., *page 834*.
Hendrich, J., 419.
Henri, Victor, 1136.
Henry, A. M., 442.
Hérics-Tóth, J. von and Osztrovszky, A. von, 675.
Hermes, A. and Holtmeier-Schomberg, H., 490.
Hess von, 934.
Higgins, J. E. and Holt, V. S., 642.
Hikkawa, S., 118.
Hill, G. R., 477.

Hill, W. S., 992.
Hiltner, L., 130, 403.
Hippolyte, L., 898.
Hitier, B., 467, 818.
Hoagland, D. R., *see* Mc Collum, E. V.
Hoepfner, P., 753.
Hoffmann, M., 318, *page 976.*
Holmes, J. D. E., 138.
Holtmeier-Schomberg, H., *see* Hermes, A.
Holt, V. S., *see* Higgins, J. E.
Holt, V. S., *see* Wilcox, E. V.
Homberger, Ernest, 989.
Honcamp, Müllner and Stau, 831.
Honcamp, Ries and Müllner, 832.
Honda, J., 455.
Honing, J. A., 618.
Hooper, C. H., 133.
Howard, 173, *page 30.*
Howard, A., 502.
Howard, A. and Howard, G. L. C., 628.
Hulme, W., 498.
Hume Harold, H., 1125.
Hunter Byron, 1153.
Hurler, *see* Pfeiler.
Hurst, H. E., 304.
Hutcheson, T. B., 889.
Hutchinson, Henry Brougham and Mac Lennan Kenneth, 1093.
Hutyra, F., *page 707.*
Hvenegaard, M., 1031.

ISTVÁNFFI, JULES, DE, 529.

JABLONOWSKIJ, J. *page 316.*
Jackson, H. V., 1027.
Jacquemin, G. and Giurel, G., 1053.
Jadin, F. and Astruc, A., 1021.
Jancsó Béla, 218.
Javillier, M., 508.
Jenny, E., 164.
Johnson, William T. Jr., *see* Ayers Henry, S.
Jona, T., 1006.
Jones, J. S. and Colver, C. W., 247.
Jones, J. U., 51.
Jordan, W. H., 213, 220.
Jorissen, A., 509.
Joret, Georges, *see* Sirot, Maurice.
Jugeat, 840.
Juritz, C. F., 494.

KALKUS, J. W., 350.
Kawase, S. and Sáito, R., 907.
Kearney, T. H., 116, 993.
Kearney, T. H., Briggs, L. J., Shantz, H. L., Mc Lane, J. W. and Piemeisel, R. L., 507.
Kellerman, K. F. and Smith, N. R., 497.
Kellerman, K. F. and Wright, R. C., 811.
Kellerman, Maude, *see* Swingle. Walter.
Kelley, W. P., 316, 613.
Kelley, W. P. and Mc George, W., 315.
Kemmer, W., 476.
Kennedy, W. J., 49.
Kerckes, Géza, 1029.
Kerpely Coloman, 130.
Kidd, Franklin, 1107.
Kiessling, L., 403.
Kiszel, Zsigmond, 427.
Kleemann, 23.
Klein, 1154.
Klein, *see* Störmer.
Klein, *see* Völtz, Zuntz and Von der Heide.
Klepzig, 527.
Klimmer and Krüger, R., 428.
Kloss, J., 672.
Kloss, J. and Schneider, F., 850.
Klünker, 570.
Knapp, A. W., 237.
Knispel, Oskar, 358.
Knowles, C. H., 34.
Köck, G., 609.
Koerfer E., *page 1542.*
Köhler, *see* Fingerling, Reinhardt, Bretsch, Arndt and Dietrich.
Kondo, Kuro, 382.
Kondo, M., 725.
König, J., Hasenbäumer, J. and Krönig, R., 704.
Kooper, W. D., 569.
Koppen, H., 418.
Köppen, Wilhelm von, 770.
Kövessi, François, 887.
Kowarzik, Rud, 361.
Kratzmann, E., 21.

Kreidl, and Lenk, 676.
Kroemer, 530.
Krönig, R., *see* König, J. and Hasenbäumer, J.
Krüger, E., *page 294.*
Krüger, R., *see* Klimmer, M.
Kufferath, H., 1058.
Kusnezow, W., 624.

Labarde, J. and Delbavie, J., 945.
Lafforgue, G., 545.
Lafont, F., 759.
Lahitte, Emilio, 280.
Lambert, M., 1037.
Laur, E., *page 171*, 379, 1050.
Laurie, D. F., *page 1400.*
Lavenir, P., *page 9*, 165.
Leake, H. Martin and Ram Prasad, 626.
Leather, J. W., 125.
Lécaillon, M., 354.
Le Clerc, J. A. and Yoder, P. A., 331.
Ledelver, F. and Berkhout, A. E., 706.
Leersum, P. von *see* Bernard, Ch.
Lefort, G., *see* Malpeaux, L.
Legendre, A. F., 556.
Leiningen Graf zu, 411.
Lemarié, Ch., 899.
Lenk, *see* Kreidl.
Leplae, E., 3.
Lesage, Pierre, 109.
Lichtenberger, 53.
Lilienthal, *see* Hansen, Reisch and Ewald.
Lint, H. Clay, 979.
Little, C. C., 356.
Little, C. C. and Philips, J. C., 145.
Livingston, B. E. and Livingston, G. J., 97.
Livingstone B. E., *see* Shive, J. W.
Livingston, G. J., *see* Livingston, B. E.
Loew, O., 100, 600.
Löhnis, F., 380.
Löhnis, F. and Green, H. H., 496.
Lomonaco, R., *see* Paolini, V.
Long James, 1177.
Lösche, *see* Fingerling, Bretsch and Arndt.
Loughridge, R. H., 599.
Loyer, Henri, 893.
Lucas, J. E., 152, 460.
Lucet, Adrien, 445, 534.
Luiggi, Luigi, 878.
Lundwall, Erich, 360.
Lur-Saluces, (Comte de), 531.
Luyk, A. v., 337.
Lynde, C. J., and Dupré H. A., 308, 309.
Lyon, T. Lyttleton and Bizzell James A., 707.

Mac Cready, S. B., *page 571.*
Mac Dowell, E. C., 449.
Macfarlane John, I., 532.
Mac Indoo, N. E., 554.
Mackenzie, K. J. J., Marshall, F. H. A. and Hammond, J., 1140.
Mackintosh, J., *see* Garrad G. H.
Mac Lennan Kenneth, *see* Hutchinson Henry Brougham.
Makrinoij, F., 209.
Malpeaux, L. and Lefort, G., 205.
Manaresi, A., 426.
Manceau, E., 641.
Mann, Albert, 882.
Mann, C. W. *see* Stubenrauch, A. V.
Mann Harold, H., 780.
Manrin, 262.
Maquenne, L. and Demoussy, E., 612.
Marchadier and Goujon, 542, 1109.
Marcus, P., 70.
Marenghi, Ernesto, 845, 1164.
Maresch, H., 465.
Marrin, G., 940.
Marshall, F. H. A., *see* Mackenzie, K. J. J. and Hammond J.
Marshall, F. R., 1150.
Marsh, C. Dwight and Clawson, A. B., 916.
Marsh, Hadleigh, 916.
Martin, 282.
Martinand, V., 1051.
Martin John, N., 985.
Martiny Benno, 451, 459.
Marx, Th., 521.
Mason, S. C., 135.
Matenaers, F. F., 514.
Matiasic, Fr., 747.

Mausberg, A., 103.
May, N. S., 922.
Mazé, P., 19, 503, 986.
Mc Beth, I. G. and Smith, N. R., 601.
Mc Collum, E. V. and Hoagland, D. R., 41.
Mc. Cool, M. M., 717.
Mc George, W., *see* Kelley, W. P.
Mc Kee Roland, *see* Piper, C. V., Evans Morgan, W. and Morse W. J.
Mehmedbašić Mahmut, 153.
Mellet R., *see* Chuard, E.
Mendel, L. B., *see* Osborne, T. B.
Mengelbier, O., 370.
Mensio, R. and Garino Canina E., 1168.
Merz, A. R., 212.
Meyer, D., 17.
Meyer, G. and Fink, E., 362.
Mezey Béla, 644.
Mezzadroli, G., *see* Munerati, O., Zapparoli, T. V.
Michel, E., 936.
Miège, E. and Compain, E., 501.
Miège, Em. and Coupé, B., 990.
Miège, F., *see* Blaringhem.
Mikulowski-Pomorski, 215.
Miller, C. F., 879.
Miller, F., 814.
Miller, F. A., 117.
Miller, N. H. J., 202.
Miyake, K. 13.
Molich, H., 221.
Molliard Marin, 884.
Molz, E., 434.
Mommsen, Christian, 165.
Monod, Th., 544.
Monti, E., 946.
Mori, S., *see* Toyana, K.
Morison, C. G. T. and Doyne, H. C., 313.
Morison, C. G. T. and Sothers, D. B., 312.
Morse, W. J., *see* Piper, C. V., Evans Morgan, W. and Mc Kee Roland.
Mottet, S., 506.
Müller, 553.
Müller, A., 812.
Müller Max, 93.
Müller Max and Narabe K., 650.
Müller, P., 48.
Müller, Robert, 447.
Müllner, *see* Honcamp and Ries.
Müllner, *see* Honcamp and Stau.
Mumford Herbert, W. and Hall Louis, D., 679.
Mundt, L., 227.
Munerati, O., Mezzadroli, G., Zapparoli, T. V., 823.
Muñoz del Castillo José, 614.
Münter, F. and Robson W. P., 98.

Nakamura, M. M., 456.
Nalloch, Y. R., 872.
Narabe, K., and Müller Max.
Neuberger, Fr., 504.
Neumann R., 500.
Nicolas, L., 126.
Nilges, H., 176.
Nilsson-Ehle, H., 720.
Nitescu Marcel, 775.
Nolhant, A., *see* Frateur J. L.
Nyarady Joan, *page 1143*.
Nyström, *see* von Feilitzen.

Obermayer Ernö, 223.
Oliver, F. W., 245.
Onori, R., 874.
Osborne, T. B. and Mendel, L. B., 142, 833.
Ostermayer, Adolf 276, 847.
Osztrovszky, A., von, *see* Hérics-Tóth, J. von.
Othis, D. H., 167.

Padula, Th., 7.
Palibine, J. W., 329.
Panayotis, A. Décazos, 527.
Pannain E., 1008.
Paolini, V. and Lomonaco, R., 1006.
Parker, E. G., 204.
Parker, G. H., 352.
Parker, W. H., 616, 1103.
Páter Béla *page 26*, 117.
Pearl, R. and Boring, A. M., 453.
Pécsi Dani, 1138.
Pedroso, A., 733.
Pée-Laby, 671.

Peglion Vittorio, *page 1146.*
Peirce George, J., *see* Darsie Marvin, L. and Elliott Charlotte.
Pellet, H., 739, 777.
Pennington, M. E. 175.
Peritourine, 14.
Perkins Arthur, J., Phillips, J. H., Spafford, W. E. and May, N. S., 922.
Perrot Em., 301.
Petch, T., 248.
Petrow, G. G., 111.
Pfeiler and Hurler, 1018.
Philips, A. G., 1033.
Philips, J. C., *see* Little, C. C.
Phillips, E. F., 1035.
Phillips, J. G., 155, 353.
Phillips, J. H., 922.
Pickering, S. U., *see* Bedford, Duc de
Pieper, H., 722.
Pigorini, L., 1099.
Pillaud, H., 457.
Piper, C. V., Evans Morgan, W., Mc Kee Roland and Morse, W. J., 894.
Pisoschi Elia, 1012.
Plate, F., 988.
Plefs, C. E., *see* Eppes, E. B.
Plehn, M., 156.
Polimanti Osw., 50.
Popenoe Wilson, 1128.
Popeuve Paul, B., 910.
Poppe Kurt, 919.
Porcher, Ch., 255.
Porchet, F., *see* Faes H.
Pratt, D. S., Thurlow, L. W., Williams, R. R. and Gibbs, H. D., 738.
Prentiss Armsby Henry, 1028.
Prescott, J. A., 1088.
Pridham, J. T., 994.
Priego, J., *page 836.*
Priestley, J. H., 604.
Prudhomme, Em., 31.
Puchner, H., 267.

Rabak Frank, 885.
Raczkowski de Sig. *see* Bordas, F.
Ram Prasad, *see* Leake H. Martin.
Raquet, H., 548.
Rather, J. B., 475.
Reed, O. E., 928.
Reinhardt, *see* Fingerling, Köhler Bretsch, Arndt and Dietrich.
Reisch, *see* Hansen, Ewald and Lilienthal.
Reisch, E., *see* Hansen and Schweiger, M.
Requinyi, G., 670.
Restana, R. Paulo, 243.
Rész Albert, 430.
Rettger Leo, F., 261.
Rezek, I., 160.
Rhodes, F. W., 452.
Rhodin Sigurd, 710.
Richardson, C. W., 513.
Ries, M., *see* Bardy, P.
Ries, *see* Honcamp and Müllner.
Riffart, B., *see* Tillmanns, J. and Splittgerber, A.
Ringelmann, M., 56, 265, 557, 660.
Rivière, Ch., 435, 750, 893.
Rivière, G. and Bailhache G., 320, 912.
Robertson, C. C., 1127.
Robertson, Fred. E. and Dodge Lawrence, G., 60.
Robertson, G. S., 214.
Robertson, J. B., 43.
Robinet, *see* Guillochon, Verry and Tournieroux.
Robson, W. P., *see* Münter, F.
Roehrich Olivier, *see* Chevalier Aug.
Roemer, Th., 325, 719.
Rogers, L. A. and Dahlberg, A. O., 572
Romanovitch, 918.
Rose, H., 727.
Rosengren, L. P., 68.
Rosmanit Ritter von, 547.
Rouillard, *see* Claude.
Ruddick, J. A., *page 162.*
Ruehle, J. K., *see* Harding H. Q.
Rümker von, K., 559, *page 578.*
Rümker von, E. and Alexandrowitch J., 625.
Russell, E. J., 314.
Russel, W., 505.

Sagawe, B., 567, 769.
Sáito, R., *see* Kawase, S.
Saleeby, M. M., 124.
Salmon, E. S., 512.
Samarani Franco, 1143.
Sanfelici Ricciardo, 178.
Sartory A., *see* Bertrand.
Sbrozzi Dino, 516.
Scala, A., *see* Alessandrini, G.
Scassellati-Sforzolini Giuseppe, 357.
Schazap, A., *see* Graaff, W. C. De
Schaeffer, G., 120, 250.
Schantz, M., 342.
Schantz, H. L., *see* Briggs Lyman J.
Scheunpflug, 930.
Schinn, C. H., 137.
Schmidt K., *page 1391*, 983.
Schneider, F., *see* Kloss, J.
Schneidewind, 699.
Schönland, S., 1123.
Schotta, *see* Freckmann, W.
Schöttler and Gläser, 830.
Schül, L., 622.
Schulze Georg, 771.
Schultze, W., 820.
Schuppli Paul, 1148.
Schweiger, M., *see* Hansen and Reisch E.
Schwyzer, F., 539.
Sedlmayr, E. E., 168, 489.
Senft, E., 827.
Severson, B. O., *see* Cochel, W. A.
Seyderhelm, A., 917.
Seyderheim, K. R., 917.
Shaw, J. W., 1040.
Shaw, G. W., 1108.
Shaw, H. B., 808.
Shaw, T. K., 115.
Shaw, W. N., 200.
Sherman, J. M., 810.
Sherman, W. A., Taylor Fred. and Brand, C. J., 122.
Shive, J. W. and Livingstone, B. E., 816.
Shorey, E. C., 409.
Shreve, F., 203.
Shrewsbury Herbert, S., 1146.
Shroff, K. D., 1156.
Sievers, A. F., 112.
Simois, D. L., *page 424*.
Sirot Maurice and Joret Georges, 880.
Skinner, J. J., 210.
Skinner, J. J. and Sullivan M. X., 613.
Small, W., 824.
Smith Frank, and White C. T., 1016.
Smith, F., *see* Brünnich, J. C.
Smith, N. R., *see* Mc Beth, I. G.
Smith, N. R., *see* Kellerman, K. F.
Smith, W. G. and Crampton, C. B., 304.
Smith, U. W., 44.
Snyder, W. P., Burr, W. W. and Burnett, E. A., 415.
Sobotta, *see* Freckmann, W.
Söderbaum, H. C., 417, 420.
Somerville, W., 1112.
Sothers, D. B., *see* Morison, C. G. T.
Southworth William, 1105.
Spafford, W. J., 922.
Spencer, J. B., *page 1154*.
Splittgerber, A., *see* Tillmanns J. and Riffart, H.
Sprague, T. A. and Boodle L. A., 1132.
Spring, F. G., 1092, 1118.
Stau, *see* Honcamp and Müllner.
Steinegger, 69.
Stella, L. M., 32.
Stempel, G., *see* Wenzel, V.
Stevenson, W., 177.
Stewart, M. N., 306.
Stieger, 774.
Stimmelmayr, A., 517.
Stockman Stewart, 446.
Stoklasa J. and Zdobnicky, V., 322.
Stoltzencerg, H., 216.
Stone, G. E., 113.
Störmer and Klein, 1144.
Straus, V., 263.
Strecker, 102.
Stubenrauch, A. V. and Mann C. W. 478.
Stutzer, A., *page 155*, 606.
Subramania Aiyer, P. A., *see* Harrison, W. H.
Sullivan, M. X., *see* Skinner, J. J.
Surányi János, 425.

Swanowetz, E., 1166.
Swanson, C. O., *see* Willard J. T.
Swingle Walter, E., 133, 913.
Swingle, Walter and Kellerman, Maude, 533.
Szanyi, St., *see* Grotz, O.

TACKE, *S. 313.*
Tacke, Br. and Brüne, Fr., 105.
Tanner, Carl, 274.
Tanret, Charles, 610.
Tarchetti, A., 841, 843.
Tassinari, G., 1167.
Taylor, Fred., *see* Sherman, W. A. and Brand, C. J.
Taylor, H. W., 1113.
Theiler, A., 1019.
Thomson, E. H. and Dixon, H. M., 375.
Thöni, J., 472.
Thurlow, L. W., *see* Pratt, D. S., Williams, R. R. and Gibbs, H. D.
Tietz, P., 57.
Tillmanns, J., Splittgerber, A. and Riffart, H., 852.
Tilmant, J., 29.
Timberg, M. G., *page 158.*
Toulaïkoiff, N., 987.
Tournieroux, *see* Guillochon, Verry and Robinet.
Tournois, Julien, 903.
Toyana, K. and Mori, S., 147.
Trabut, 440.
True, R. H., *see* Young, T. B.
Truka, Rudolf, 876.
Truog, E., 877.
Tschumy, L., *see* Chavan, P. and Dusserre, C.
Turrentine, J. W., 106.

UHLMANN, E., 550.
Underwood, L. M., *see* Brenchley W. E. and Hall A. D.
Utt, C. A. A., 1056.

VAN BARNEKOW, HANS, 1149.
Vandekerkhove, E. M., 123.
Van der Zande, K. H. M., *page 971.*
Van Fleet, W., 348.
Van Helten, W. M., 104.
Van Slyke, L. L. and Bosworth, A. W., 283, 1172, 1176.
Vas, K., *see* Gratz, O.
Vendl., 205.
Ventre, Jules, 1055.
Veratti, S., 773.
Vercier, J., 828.
Vermorel, V. and Danthony, E., 18.
Verne, C., *see* Heckel, E.
Verry, *see* Guillochon, Tournieroux and Robinet.
Vestergaard, A. B., *page 419.*
Viasz, József, 535.
Vignerot, *see* Dornic, Daier.
Villard, Victor, *see* Desmoulins, Amédée.
Vinassa de Regny, Paolo, *page 19.*
Vine, H. C. A., 229, 332.
Vinson, A. E., 978.
Vivenza, A., 431.
Volck, W. H., *see* Ballard, W. S.
Völtz, Wilhelm, Baudrexel, August and Deutschland, Arnold, 645.
Völtz, Zuntz, Von der Heide and Klein, 143.
Von May, F., 712.
Vuillet, J., 239, 734.
Vuillet, J., *see* Ammann, P.

WACKER, H., 334, 728.
Wagner, P., 815.
Walker Tisdale, C. W., *page 985.*
Wallace, R. and Watson, J. A. S., *page 506.*
Walther, Ad. R., 655.
Warburg, O., 195.
Ward, W. F., *see* Cotton, J. S.
Ward, W. F., *see* Gray, Dan T.
Warth, F. G. and Darabzett, D. B., 611.
Washburn, H. J., 663.
Waterstradt, F., 667.
Watson, J. A. S., *see* Wallace, R.
Watt, A., 201.
Wauters, P., *page 1.*
Wedemann, W., 470.
Weibull, M., 597.

Weigmann, 781.
Weigmann and Wolff, 1061.
Weinzierl, (Ritter von) Th., *page 299*.
Weirup, 743.
Weiser, E., *page 432*.
Weiser, Stephan, 921.
Weitz, G., 376.
Wellmann, 260, 1148.
Wentworth, E. N., 144, 151.
Wenzel, V. and Stempel, G., 338.
Wery, Georges, 8.
Wester, P. J., 438, 443, 643.
Whatmough, W. A., 1009.
Whiting, R. A., *see* Craig, R. A.
Wigger, A., 1022.
Wild, L., 995.
Wildeman, E., 127, 627.
Wilcox, E. V. and Holt, V. S., 344.
Willard, J. T. and Swanson, C. O., 383.
Williams, G. C., 1117.
Williams, R. R., *see* Pratt, D. S., Thurlow, L. W. and Gibbs, H. D.
Wilson, J., 363.
Wilson, J. K., *see* Harding, H. A.
Winton, K. B., 351.
Wirth Heinrich, 662.
Wittmack, L., 732.
Wlodeck, J., 713.
Woeikof, A., 121.
Wohltmann, 9.
Wolff A., 66.
Wolff, *see* Weigmann.
Wollák, Charles, 1137.
Wood, C. E., 998.
Wood, T. B. and Yule Udny, G., 1147
Wriedt, Chr., 834.
Wright, R. C., *see* Kellerman, K. I.
Wunscherdorff, 886.

YODER, P. A., *see* Le Clerc, J. A.
Young, C. C., 929, 1152.
Young, T. B. and True, R. H., 343.
Yule Udny, G., *see* Wood, T. B.

ZADE, A., 727.
Zaepfel, Edgar, 817.
Zailer, V., 813.
Zaitschek, A., 752.
Zappa, R., *page 598* and *712*.
Zapparoli, T. V., *see* Munerati, O. and Mezzadroli, G.
Zavitz, C. A., 1110.
Zdobnicky, V., *see* Stocklasa.
Zederbauer E., 326, 1133.
Ziffer, A., 230.
Zimmermann, A., 241, 630.
Zimmermann, E., 29.
Zimmermann, H., 72.
Zon, R., 1014.
Zasmar, György, 537.
Zulueta, José, 1124.
Zuntz, N. 143, *page 435*.
Zweifler, Fr., 573.

III. — PLANT DISEASES

A) INDEX OF SUBJECTS.

ABIES GRANDIS : Wood-destroying Fungi, 962

Abies pectinata : Injurious Insects observed in Ireland, 86.

Abu el mum, 963.

Acacia : Uganda Coccidae, 293. *A. arabica* host of *Pseudococcus filamentosus*, 697.

Acœna ovina and *A. Sanguisorbae* or " sheep burrs ", 88.

Acanthosoma haemorroidale, 86.

Acer: Wood-destroying Fungi which Grow on Both Coniferous and Deciduous Trees in the United States of America and in Europe, 962. *A. saccharinum*, 398.

Acheta morio, an Orthopterous Insect injurious to Sisal in German East Africa, 194.

Acontia graellsii on Cotton, 690.

Acrida turrita on Tobacco, 690.

Acridium lineatum on Tobacco, 690.

Acrocercops sp., 1195.

Acrotylus patruelis on Tobacco, 690.

Adoretus hirtellus, 391 ; *A. vestitus*, 869.

Aecidium : A. Grossulariae, 76. *A. Epimedii*, 481. *A. Mori*, 578. *A. parile* on *Loranthus*, 787.

Africa : Parasites of the Fruit Fly, 190. *Acheta morio* injurious to Sisal in German East Africa, 194. On the Occurrence of *Aphis maidis* in West Africa, 487. *Pseudococcus filamentosus* on Tropical Trees, 697. Leaf Spot Disease of Sisal in German East Africa, 785.

Agave rigida var. *sisalana*, *see* Sisal.

Agrilus biguttatus, 76.

Agriotes sp., in Sweden, *p. 1546*.

Agromyza : A. pusilla on Alfalfa, etc., in U. S. A., 87. *A. pruinosa* on *Betula nigra*, in U. S. A., parasitised by *Sympha agromyzae*, 591.

Agropyron : The Occurrence of Rust Spores, 73. Notes on the Biology of Leather Jackets, *Tipula oleracea*, 964. Experiments on the Food Requirements and Growth of Couch, *Agropyron repens*, 1191.

Agrotis : A. corticea on *Trifolium pratense*, 292. *A. segetum*, 86.

Aira caespitosa, *p. 303*.

Alang-Alang, 250.

Albizzia Lebbek, host of *Pseudococcus filamentosus*, 697.

Aleyrodes vaporiarum on *Azalea indica*, 297.

The figures in italics refer to the number of the page, the others to the number of the abstract.

Alfalfa: The Serpentine Leaf-miner, *Agromyza pusilla*, 87.

Algeria: The Rotting of Bunches of Grapes produced by *Phoma* sp., 80. The Importation of Cotton Seed, 179. Decree of the President of the French Republic, April 18, 1914, relating to the Importation into Algeria of Plants other than Vines and Resin-yielding Trees, 681.

Allorhina nitida, 864.

Allotria, parasitic on *Aphis evonymi*, 800.

Alloxysta, parasitic on *Aphis evonymi*, 800.

Almus: Wood-destroying Fungi in the United States, 962.

Althaea rosea: The Hereditary Transmission of Rust in Hollyhock, 290.

Amaranthus retroflexus: Impurities in Seeds in Victoria, Australia, 724.

Amaryllis, 974.

Amatina consorta, 1195.

Anagrus ovijentatus, a Hymenopterous Parasite of the Eggs of *Lygus pratensis*, 692.

Andropogon: Uganda Coccidae, 293. *A. scoparius*, host of *Blissus leucopterus*, 588. *A. Sorghum* in India, 481.

Anoda triangularis in the Argentine Republic, 623.

Anomopterus fasciipennis, New Genus of Hymenoptera Parasitic on *Ectoedemia*, 802.

Anona muricata in Uganda, 293.

Anthemis Cotula in Tasmania, 286.

Anthomyidae, 397.

Anthonomus grandis var. *thurberiae* (a Cotton-Boll Weevil) on *Thurberia thespesioides*, in Arizona, 193.

Anthurium magnificum, 797.

Antiperonospora, 793.

Apamea gemina, 292.

Aphelinus: New Species of *Aphelinus* Parasitic on Injurious Aphids in Russia, 801.

Aphidius parasitic on *Aphis evonymi*, 800.

Aphids in Belgium, 76.

Aphis: *A. bituberculata* on Sugar Cane, 866. *A. evonymi*, 296, 800 and 965. *A. maidis*, 487. *A. pomi*, 86. *A. scaliae*, 1181. *A. sorbi*, 86. *A. sorghi*, 487.

Apogonia comosa, 1084.

Apple: *Cicinnobolus* sp. Parasitic on Apple Mildew, *Oidium farinosum*, 75. Injurious Insects and Other Animals observed in Ireland during the Year 1912, 86. The Control of the Codling Moth in the Sacramento Valley, California, 399. Small Ermine Moths (*Hyponomeuta malinella* and *H. padella*) in the United States, 400. The destruction of Woolly Aphis by Fumigation with Hydrocyanic Acid, 587. Parasitic Fungi from Northern Japan, 789. *Recurvaria nanella* in the United States, 804. The Status of Investigational Work on Apple Blight, 952. A contribution to our Knowledge of Apple Scab, 959. *Malacosoma* sp. injurious in California, 1196.

Apricots: Fungi injurious in Servia, 1184.

Apterite, *p. 1412*.

Arctium Lappa and *A. minus* in Tasmania, 286.

Argentine Republic: the Cultivation of Sugar Cane, *p. 424*. *Euxesta chavannei* and its Relation to the Sugar Cane Disease caused by *Bacillus Sacchari* in the Province of Tucuman, 1079.

Armillaria mellea, Wood-destroying Fungi in the United States, 962.

Arsenic, chemical means for the control of Parasites of Farm Crops, 88, 180, 392.

Artocarpus incisa, 787.

Artona waleri parasitic on Rice in Conchinchina, 971.

Asbecesta cyanipennis, 690.
Ascochyta Gerberae n. sp., parasitic on *Gerbera Jamesoni*, 186.
Ascomycetes, 789.
Asphodelus fistulosus in Tasmania, 286.
Aspidiotus: *A.* spp. in British Guiana, 797. *A. bromeliae* and *A. ficus* in the Seychelles, 798. *A. bromeliae*, 967. *A. aonidum* and *A. aurantii* in Egypt, 970. *A.* sp. in Ceylon, 1195.
Aspidistra, 76.
Asterolecanium sp., 797.
Atelocera serrata in Belgian Congo, 1080.
Attacus atlas, 1195.
Aulacaspis rosae on *Mangifera indica* and on *Laurus Cinnamomum*, 797.
Australia: *Haltica pagana* in Victoria, 88. *Godara comalis*, a Cabbage Moth Attacking Turnips in Queensland, 868. Potato Diseases in Victoria, Australia, 1070. The "Leaf Case Moth" (*Hyalarcta hübneri*) injurious to Fruit Trees in Victoria, 1083.
Austria: Contribution to the Mycological Flora of the Tyrol and Istria, 788. Experiments in Growing Medicinal Plants at Korneuburg, 827. Results of Investigations made in Austria in 1913 into the Leaf-curl of Potatoes, 858.
Avocado: The Scale Insects of British Guiana, 797. *Xyleborus* sp. on Avocado, 1195.
Azalea indica, 297.
Azia trinitatis, 797.

BACILLUS AMYLOVORUS: Status of Investigational Work on Pear and Apple Blight, 952.
Bacillus Cortynae, *B. Pyrameis I* and *B. Pyrameis II*, parasitic on the larvae of *Gortyna ochracea* and *Pyrameis cardui*, 84.
Bacterium aptatum n. sp. Injurious to the Leaves of Sugar Beets and Nasturtium (*Tropaeolum*) in the United States, 483. *B. castaniculum* n. sp., 484.
Baden: Phytopathological Observations in the Grand Duchy, 1913, 577.
Bagworm, 1195.
Bamboos: *Bambusa* sp. 697. *Coniosporium Shiraianum* in Tyrol, 788. *Asterolecanium bambusae*, common on bamboos, in British Guiana, 797.
Bananas: *Aspidiotus destructor*, 797. Parasitic Fungi collected in the Straits Settlements and Fiji Islands, 1066.
Baris sp., 86.
Barley: Occurrence of Rust Spores in the Interior of Barley Grains, 73. Contribution to the Biology of Naked Smut of Barley, *Ustilago nuda*, 74. *Ustilago Hordei*, 76. In Egypt, 387. *Pleospora trichostoma*, 388. *Bibio hortulanus*, 691.
Bathurst Burr, *Xanthium spinosum*, 286.
Bean: Insects injurious in the Nyasaland Protectorate, 690.
Beets: The Life-History of *Aphis evonymi*, Injurious to Sugar Beets, 296. The Cultivation of Sugar Beets in the Island of S. Miguel in the Azores, 434. *Bacterium aptatum* n. sp., injurious to the leaves of Sugar Beets in the United States, 483. Phytopathological Observations in the Grand Duchy of Baden, 577. Hymenoptera Parasitic on *Aphis evonymi*, the Beet Aphis, 800. Observations on the Life-History of the Beet Aphis (*Aphis evonymi*), 965.
Belgian Congo: Fungus Diseases of Hevea, 1071. Diseases of Cacao, 1072. *Sahlbergella singularis* on the Cacao, 1080.
Belgium: Diseases and Pests of Plants in Belgium in 1911 and 1912, 76. *Aleyrodes vaporiarum*, a Para-

site of *Azalea indica* in Belgium, 297.
Berberis nepalensis, 1192.
Betula : Wood-destroying Fungi in the United States, 962. *B. nigra*, injuried by *Agromyza pruinosa*, 591.
Bibio hortulanus : Contribution to the Biology of *Bibio hortulanus*, and its Control, 691.
Bidens leucanthus and *B. scabiosoides* in the Argentine Republic, 623.
Big Bluestem, *Andropogon furcatus*, host of *Blissus leucopterus*, 588.
Black Rot, *Guignardia Bidwellii*, in Spain, 958.
Blastodacna vinolentella, 86.
Blattrollkrankheit of Potato, 577, 580, 683, 858.
Blighia sapida, 797.
Blissus leucopterus, 588.
Blister Blight of Tea in India, 244.
Blossom-End Rot, 1182.
Borassus flabellifer, 962.
Bordeaux Mixture, 577, 1069.
Botrytis : *B. anthophila* n. sp. on *Trifolium pratense* in Russia, 955. *B. necans* on *Brachastona catoxantha*, 1066.
Brachastona catoxantha, 1066.
Brachycolus noxius, 294.
Brachysporium Phragmitis, 481.
Brachytrypes membranaceus on Cotton, 690.
Bramble-leaf : The Presence of Endocellular Fibre in the Tissues of the Vine and of other Dicotyledons, 576. Observations on Bramble-leaf of Vines in Hungary, 684.
Brazil : *Stilbum flavidum*, 78. *Remigia repanda* (Lepidoptera), injurious to Crops in São Paulo, 803.
Brevipalpus obovatus, 1195.
Bromus mollis, 73.
Broussonetia Kazinoki injured by *Aecidium*, 978. *B. papyrifera*, 790.
Bryobia praetiosa in Sweden, *p. 1546*.
Bud rot, *Pythium palmivorum*, 961.
Buckwheat : *Fagopyrum tartaricum* as a Weed among Buckwheat in Volhynia (Russia), 82.
Bud-rot of Coconut Palms (*Pythium palmivorum*) in Malabar, 961.
Bunch grass, *Andropogon scoparius*, 588.
Burdock, 286, 398.
Burgundy Mixture, 954.
Busseola fusca on Maize, 690.

Cabbage : Diptera injurious to Cabbages, 397. Phytopathological Observations in the Grand Duchy of Baden, 1913, 577. *Godara comalis*, a Cabbage Moth, Attacking Turnips in Queensland, 868.
Cabbage Webworm, *Hellula undalis*, 868.
Cacao : Diseases and Pests, Legislation in Ceylon, 285. A List of Uganda Coccidae, 293. Entomological Pests of Southern Nigeria, 391. The Scale Insects of British Guiana, 797. Fungus Diseases of Cacao in the Mayumbe, Belgian Congo, 1071, 1072. *Sahlbergella singularis* and other Pests on Cacao in the Mayumbe, Belgian Congo, 1080.
Californian thistle, *Cnicus arvensis*, 286.
Camphor : *Cinnamomum Camphora* in Ceylan, 1195.
Canavalia ensiformis, 787.
Candelillo, 1185.
Canker of Potato, 956, *p. 1548*.
Cape Weed, *Cryptostemma calendulaceum*, 286.
Capsicum, 796.
Caradrina, 1193. *C. reclusa*, parasitic on Tobacco in Hawaii, 1081.
Carbolineum, Chemical Means of Control, 180.
Carduus pycnocephalus, a Proclaimed Weed in Tasmania, 286, 287.
Carpinus, *p. 304*.
Carpocapsa pomonella 86, 399 and *p. 1545*.
Carragaheen : The Destruction of In-

sects Injurious to Fruit Trees and Vines by means of "Carragaheen" or "Pearl Moss" Jelly (*Chondrus crispus*), 488.

Carrot: *Erica rosae*, 86. The Effect on Carrots of being Grown in Soil infected by Finger-and-Toe, 184. Phytopathological Observations in the Grand Duchy of Baden, 1913, 577.

Catachrysops pandava, parasitic on Cycas in Ceylon, 1194.

Catantops opulentus, parasitic on Tobacco, 690.

Catopsilia crocale, on Cycas in Ceylon, 1194.

Cattleya superba, 797.

Cecidomyia of Trefoil, 1181.

Celery Leaf-spot Disease (*Septoria Petroselini* var. *Apii*) in England, 957.

Centistidea ectoedemiae n. sp., parasitic on *Ectoedemia castaneae*, 802.

Cephaleuros virescens on Cacao, 1072.

Ceratitis: *C. capitata*, 190. *C. punctata* on Cacao, 391.

Cercospora: *C. Artocarpi* on *Artocarpus incisa*, *C. Canavaliae* on *Canavalia ensiformis*, *C. pachyderma* on *Dioscorea alata*, *C. Puerariae* on *Pueraria phaseoloides*, 787. *C. Myrti* on *Myrtus*, 788. *C. Musae* on bananas, 1066.

Cerdidymsulfat, 577, 793.

Cereals: Inquiry and Observations on Straw Blight of Wheat in the Department of Aisne, France, 77. *Tapinostola musculosa*, a Noctuid Moth injurious to Cereals in Hungary, 192. Recent Work of the Royal Entomological Station of Hungary, *p. 316*. The Fungi causing Straw Blight of Wheat in France, 291. *Diaretus* (*Aphidius*) *obsoletus* n. sp., a Braconid Parasitic upon the Aphides *Brachycolus noxius* and *Toxoptera graminum*, injurious to Cereals in Russia, 294. Insects in Flour Mills and Granaries, 394. Phytopathological Observations in the Grand Duchy of Baden, 577. Wintering of Cereal Rusts in the Uredo Stage, 579. The Chinch Bug (*Blissus leucopterus*) injurious to Cereals in Kansas, 588. On the Presence of Sori and Mycelium of Rusts in the Caryopses of Cereals, 685. The 1914 Outbreak of Rust on Winter Grain in Bavaria, 795. Research on the Rust of Cereals in Sweden, *p. 1548*. *See also* Wheat, Oats, etc.

Ceroplastes: Uganda Coccidae, 293. Coccidae in British Guiana, 797.

Ceroputo barberi on *Schinus terebenthifolius*, 797.

Ceuthospora phacidioides var. *Oleae*, 788.

Ceylon: Diseases and Pests, Legislation, 285. *Dichomeris ianthes*, *Catopsilia crocale*, and *Catachrysops pandava*, injurious to Lucerne, Cassias and Cycads, 1194. Animal Pests of Camphor, 1195.

Chaetogedia monticola, 1081.

Chamaerops excelsa, 388.

Chacarita, *p. 287*.

Charlock: in Tasmania 286. Experiments on the Destruction of Charlock by Mechanical and Chemical Means, 577, 583.

Cheimatobia: *C. brumata*, 86 and *p. 1546*.

Chelonus: *C. blackburnii* on *Phtormaea operculella*, 1081. *C. caradrinae* parasitic on *Caradrina exigua*, 1193.

Chenopodium opulifolium, in the Argentine Republic, 623.

Cherry: *Myzus cerasi*, 86. Gummosis of *Prunus avium*, 786.

Chermes piceae, 86.

Chestnut: *Castanea americana*, susceptible to the Destructive Bark Disease *Endothia parasitica*, 348. A New Chestnut Disease, 484. The Anatomical and Physiological Conditions of Chestnut Branches attacked by the Ink Disease, 689. *Anomopterus*

fasciipennis, 802. *Polyporus frondosus*, 962. *Endothia parasitica* in the United States, 1074.
Chilomenes on Cotton, 391.
Chimney: The Importance to Vegetation of the Dissipator (Lattice-work) Chimney, 386.
China, Fungi, 578.
Chinch Bug, 588.
Chionaspis: parasitic on *Citrus* in British Guiana, 797.
Chloridea: *C. obsoleta* on Cotton, 391. on Maize and on Tobacco, 690.
Chlorita flavescens, 244.
Chondrus crispus, 488.
Chrotogonus on Tobacco, 690.
Chrysomphalus in British Guiana, 797.
Chrysopa vulgaris, 292.
Chrysophlyctis endobiotica in Belgium, 76. In Sweden, 182. On Potato, 956.
Cicas revoluta, 581.
Cichorium Intybus, 724.
Cicindela sexpunctata on *Leptocorisa varicornis*, 971.
Cicinnobulus sp., 75. *C. Humuli* parasite on *Erysiphe Polygoni* and *Sphaerotheca Humuli*, 1184.
Citrus Trees: Diseases and Pests, Legislation in Ceylon, 285. Fungus Diseases of Wheat, Barley and Citrus Fruits in Egypt, 387. *Pseudococcus filamentosus*, a Scale Injurious to Tropical Trees, 697. The Scale Insects of British Guiana, 797. *Coccus citricola*, a New Scale infesting Citrus Trees in California, 805. Relation of Bacterial Transformations of Soil Nitrogen to Nutrition of *Citrus* suffering from Chlorosis, 811. Fumigation of Citrus Trees in Egypt, 970. Insect Pests of Citrus in Ceylon, 1084. New Coccidae in Japan, 1192. *See also* Lemon, Orange, etc.
Cladochytrium Mauryi n. sp., in France, 862.
Cladosporium: *C. episclerotiale* n. sp. on *Sclerotinia cinerea*, 788. *C. herbarum*, 688.
Clasterosporium degenerans on *Prunus Mume* in Japan, 789.
Clover: The Serpentine Leaf-miner, *Agromyza pusilla*, 87. A Disease of Red Clover, 181. A New *Botrytis* on Flowers of Red Clover in Russia, 955. Further Notes on a Disease of Red Clover in Tuscany, 1181.
Cnaphalocrocis medicinalis on Rice in Cochinchina, 971.
Cnicus arvensis in Tasmania, 286.
Coccidae: in the Uganda, 293. In British Guiana, 797.
Coccinella septempunctata, 586.
Coccus: *C.* spp. in British Guiana, 797. *C. citricola* n. sp. on Citrus Fruits, 805.
Coconut: In Ceylon, 285. Coccidae in British Guiana, 798. In Cochinchina, 855. *Pythium palmivorum*, 961.
Coffee: *Stilbum flavidum*, Parasitic on Coffee, and its Systematic Position, 78. *Hemileia* in Ceylon, 285. Uganda Coccidae, 293. Entomological Pests and Problems of Southern Nigeria, 391. Insects injurious to Crops in the Nyasaland Protectorate, 690. *Lachnodius greeni*, a New Scale injurious to Coffee in Madagascar, 695. The Yellow-headed Coffee Borer (*Dirphya princeps*) in Uganda, 696. Coccidae in British Guiana, 797. In Uganda, 824. The Rose Beetle (*Adoretus vestitus*) and the Injury it Causes in the Samoan Islands, 869. In Réunion, 976. Koleroga, *Pellicularia Koleroga* in Porto Rico, 1185.
Colatura of Rice, 951.
Colchicum: *C autumnale*, 577. *Cladochytrium Mauryi* on *C. autumnale* in France, 862.
Coleophora laricella in Sweden. *p. 1545.*
Coleoptera in the Nyasaland Protectorate, 690.

Colletotrichum: *C. Agave* on Sisal in British Guiana, 859. *C. nigrum*, 796.
Colocasia antiquorum, 288. Colorado Potato Beetle, *Leptinotarsa decemlineata* in Germany, 863.
Con bu xe, *Rhynchophorus ferrugineus*, 855.
Conchylis: Recent Work of the Royal Entomological Station of Hungary, *p. 316*. Phytopathological Observations in the Grand Duchy of Baden 1913, 577. Relation between the Larvae of Vine Moths (*Conchylis ambiguella* and *Polychrosis botrana*) and the Weeds of Vineyards and Other Plants, 584. The Destruction of Woolly Aphis (*Schizoneura lanigera*) and Pear Scale (*Epidiaspis betulae*) by Fumigation with Hydrocyanic Acid, 587. *Polychrosis botrana* and *Conchylys ambiguella* in Piedmont in 1913: Biology and Control, 590. Control of the Second Generation of Vine Moths by means of Protecting Envelopes, 694. Winter Precautions against the Pupae of Vine Moths (*Conchylis ambiguella* and *Polychrosis botrana*), 969. The Practical Efficiency of Food Traps in the Control of Vine Moths (*Conchylis ambiguella* and *Polychrosis botrana*), and the Presence of the Vine Pyralid (*Oenophthira pilleriana*) in Piedmont, 1078.
Con duong, 855.
Conferences: The Recommendations of the International Phytopathological Conference, 384.
Coniosporium Shiraianum on *Bambusa*, 788.
Coniothyrium Diplodiella, 80. *C. Tiliae*, 578.
Conium maculatum, 286.
Con kien vuong, *Oryctes rhinoceros*, 855.
Con sung, *Oryctes rhinoceros*, 855.
Copper, Chemical Means of Control, 180, 577, 792, 1069.
Coptosoma siamicum, 1195.
Corky scab, *Spongospora subterranea*, 1070.
Coryneum modonium, 689.
Cosmophila erosa on the Cotton, 690.
Cotton: *Agromyza pusilla*, 87. The Importation of Cotton Seed into Algeria, 179. *Anthonomus grandis* var. *thurberiae*, 193. Diseases and Pests Legislation in Ceylon, 285. A List of Uganda Coccidae, 293. Entomological Pests and Problems of Southern Nigeria, 391. Legislative Measures in Egypt, 479. Parasites in Nyasaland, 690. *Pseudococcus filamentosus*, 697. In British Guiana, 797.
Cowpeas: The Serpentine Leaf-miner, *Agromyza pusilla*, 87.
Crataegus, Wood-destroying Fungi in the United States, 962.
Cremastogaster, Ant favouring citrus scales in Ceylon, 1084.
Crepis capillaris, 724.
Croton bug, *Orthezia praelonga*, 797.
Cryptochaetum curtipenne, 1084.
Cryptostemma calendulaceum, 286.
Cryptothrips floridensis, 1195.
Cucumber: Some Factors affecting the Susceptibility of Cucumber Plants to Burning from Hydrocyanic Acid Gas, 191.
Cupran, 793.
Cuproazotin, 577.
Cuprosulfid, 793.
Curl of the Potato, 956.
Cycas revoluta: A Leaf Disease, 581.
Cycloconium oleaginum on the *Phillyrea latifolia*, 788.
Cylindrosporium Juglandis, 582.
Cyphella Heveae and *C. villosa* parasitic on *Hevea brasiliensis*, 1066.
Cystodendron dyophilum on *Quercus lanuginosa*, 788.
Cystotheca lanestris on *Quercus glandulifera*, 789.

DACTYLIS GLOMERATA, 292.
Dactylopius sp., 293.
Dacus oleae, parasites of, 190.
Daisy fleabane, 692.
Damping-off, 794.
Darnell-grass, *Lolium temulentum*, 341.
Demerara Robin, *Leistes guianensis*, 865.
Diacantha conifera, 690.
Diacrisia maculosa on Cacao, 391.
Diadiplosis coccidivora, 1084.
Diaretus (*Aphidius*) *obsoletus* n. sp., on *Brachycolus noxius* and *Toxoptera graminum*, 294,
Diaspis boisduvalii on *Musa paradisiaca* and on *Cattleya superba*, 797. *D. echinocacti opuntiae* on *Opuntia elongata*, 797.
Dichomeris ianthes in Ceylon, 1194.
Die-back on Hevea, 1071.
Dioscorea, 391. *D. alata*, 787.
Diospyros Kaki in Japan, 1192.
Diparopsis castanea on Cotton, 391, 690.
Discosia maculiformis on *Fagus sylvatica* var. *Sieboldi*, 789.
Diplodia cacaoicola, parasitic on Hevea and on Cacao in Belgian Congo, 1071, 1072.
Diplospora graminis on the Ears and Leaves of Wheat, 1184.
Dipsacus sylvestris, 286.
Dirphya (*Nitocris*) *princeps* on Coffee in Uganda, 696.
Dörrfleckenkrankheit, 577.
Dry Disease of Sugar Cane, 860.
Dry-rot Diseases of Potato, 956.
Dry Scab of Potato, 1070.
Dysdercus on Cotton, 391.
Dust: Effect of Dust from Cement Mills on the Setting of Fruits, 639.

EARIAS: *E. biplaga* on Cotton 391. In Egypt, 479. *E. insulana* on *Hibiscus*, 690.
Echium vulgare, 286.
Ectoedemia, 802.
Egg-plant, *see Solanum Melongena*.
Egypt: Fungus Diseases of Wheat, Barley and Citrus Fruits, 387. *Ranunculus sceleratus* and *R. Guilelmi-Jordani* as Weeds, 390. Legislative Measures concerning Plant Diseases, 479. *Pseudococcus filamentosus*, 697. *Papaver Rhoeas* and *P. hybridum*, Common Weeds in Egypt, 963. The Fumigation of Citrus Trees, 970.
Eichhornia crassipes, 798.
El Khamira, *Ustilago*, 387.
Elm Leaf-Beetle (*Galerucella luteola*), Life-History, 968.
Encyrtus parasitic on *Aphis evonymi*, 800.
Endives, Loss in 1912 from *Aecidium Lactucae-sativae*, 76.
Endothia parasitica, 438, 1074.
Enemies, Natural, of Plant Parasites: A list of Uganda Coccidae and their Food Plants, 293. Entomological Pests and Problems of Southern Nigeria 391. The Scale Insects of British Guiana, 797.
Entomophthora Jaapiana, 1183.
Entyloma Oryzae on *Oryza sativa*, 787.
Epidiaspis betulae, 587.
Epilachna chrysomelina on Cotton, 391.
Epitrix parvula on Tobacco, 1081.
Erigeron ramosus, 692.
Eriobotrya japonica, 78.
Eriococcus festucae, 1192.
Eriodendron anfractuosusm, Host of *Pseudococcus filamentosus*, 697.
Eriophyies : piri, ribis and *similis*, 86 and *p. 1546*.
Eriopus floridensis in the United States, 395.
Eritrea: Decree of the Governor of the Colony of Eritrea, dated 13 July 1914, concerned the Protection of Plants, 1064.
Erysiphe Polygoni and *E. Cichoriacearum*, 1184.
Erythroxylum Coca, see Coca.
Euacanthus interruptus, 1183.

Eucalymnates perforatus in British Guiana, 797.
Eucalyptus : Hyalarcta nigrescens, 1083.
Euclea indetermina, 396.
Eudemis: Recent Work of the Royal Entomological Station of Hungary, *p. 316*. Relation between the Larvae of Vine Moths and the weeds of Vineyards and other Plants, 584. *Polychrosis botrana* and *Conchylis ambiguella* in Piedmont in 1913 ; Biology and Control, 590. Insects injurious to Crops in the Nyasaland Protectorate, 690. Control of the Second Generation of the Moths by means of Protecting Envelopes, 694. Winter Precautions against the Pupae of Vine Moths in Piedmont, 969. The Practical Efficiency of Wood Traps in the Control of Vine Moths and the Presence of Vine Pyralid, 1078.
Eugenia: Coccidae in British Guiana, 797.
Eumerus strigatus, 974.
Eusclerospora 481.
Euxesta chavannei n. sp. on the Sugar Cane, 1079.
Euxoa segetum on Tobacco, 690.
Exobasidium Azaleae, 76.
Exobasidium vexans, 244.
Exochomus nigromaculatus on *Pseudococcus filamentosus*, 697.
Exosporium Ulmi in Sweden, *p. 1546*.

FAGOPYRUM TATARICUM in Russia, 82.
Fagus : Wood-destroying Fungi in the United States, 962. *F. sylvatica* in Japan, 789.
False redtop, *Triplasis purpurea*, Host of *Blissus leucopterus*, 588.
Fenugreek Seeds, 886.
Festuca duriuscula and *F. elatior*, 292.
Fig: Parasitic Fungi from Formosa, 790.
Fiji Islands: Parasitic Fungi, 1066.
Finger-and-Toe: The Effect on Carrots and Spinach of being grown in Soil infected by Finger-and-Toe, 184.
Flax: *Longitarsus ater*, 86. *Melampsora Lini*, 788.
Florida Fern Caterpillar, *Eriopus floridensis*, in the United States, 395.
Florida wax scale, *Ceroplastes floridensis*, 797.
Folgekrankheit, 858.
Fomes : Wood-destroying Fungi, 962, *F. putearius* n. sp. and *Trametes setosus* n. sp., 1075. *F. semitostus* on Hevea in Conchinchina, 629 ; in Belgian Congo, 1071.
Food Traps : The Practical Efficiency of Food Traps in the Control of Vine Moths and the Presence of the Vine Pyralid in Piedmont, 1078.
Forhin, 793.
Formalin: Chemical Means of Control, 180. Wart Disease of Potato, 182.
Formosa, *see* Japan.
France: Inquiry and Observations on Straw Blight of Wheat in the Department of Aisne, 77. Acclimatization of *Novius cardinalis*, 85. American Gooseberry Mildew (*Sphaerotheca mors-uvae*) recorded from France, 183. The Fungi causing Straw Blight of Wheat, 291. Insects and Mites Injurious to Cultivated Plants, 295. A Law Placing at the Disposal of the Minister of Agriculture from the Budget of 1913 the Sum of 750 000 fr. for the Control of Voles, 385. *Thripoctenus brui* n. sp. a Chalcid Parasite of *Frankliniella robusta* injurious to Peas, 585. Decree of the President of the French Republic, April 18, 1914, relating to the Importation into Algeria of Plants other than Vines and Resin-yielding Trees, 681. Act allotting 500 000 Francs to the Minister of Agriculture for the Control of Voles, 682. Resistance of Hybrid Direct-Bearer Vines to Mildew, 686. Decree of the President of the

French Republic, June 9, 1914, Authorizing the Introduction into France of Plants other than Vines through the Dijon Customs House, 853. *Cladochytrium Mauryi* and *C. Ollivieri*, New Phycomycees on the Leaves of *Colchicum autumnale* and of *Orchis incarnata* and *O. laxiflora*, 862. Damage caused by *Marssonia Rosae*, in the Roseries near Lyons, 1073. *Otiorrhyncus sulcatus* attacking Vines in the Ile d'Oléron, 1085.

Frankliniella robusta, 585.

Fraxinus, *p.* 304. *Fraxinus longicuspis* in Japan, 789.

French cashew, *Eugenia Jambolana*, 797.

Froghopper, *see Tomaspis*.

Frontina archippivora parasitising *Caradrina reclusa*, 1081.

Frost: Partial Damages on Winter Cereals resembling Damage by Wild Animals, 72. *Ascochyta Gerberae* n. sp., Parasite of *Gerbera Jamesoni*, an Ornamental Composite, 186.

Fruit trees: *Hyalopterus pruni*, *Myzus ribis* and *M. cerasi*, 76. Parasites in Africa, 190. The Destruction of Insects Injuriousto, 488. Phytopathological Observations in the Grand Duchy of Baden, 577. *Pseudococcus filamentosus*, 697. In New South Wales, 1082. *Hyalarcta hübneri* in Victoria, 1083.

Fumigation: With Prussic Acid, 180. The Destruction of Woolly Aphis and Pear Scale by Fumigation with Hydrocyanic Acid, 587. The Fumigation of Citrus Trees in Egypt, 970.

Fungi: Some Chinese Fungi, 578. New Fungi, 787. Contribution to the Mycological Flora of the Tyrol and Istria, 788. Parasitic Fungi from Northern Japan, 789. Parasitic Fungi from Formosa, 790. Wood-destroying Fungi which grow on both Coniferous and Deciduous Trees, 962. Parasitic Fungi collected in the Straits Settlements and Fiji Islands, 1066. Contributions to the Cryptogamic Flora of Thuringia, 1183. Contribution to the Mycological Flora of Serbia, 1184.

Fungicides: Chemical Means for the control of Parasites of Farm Crops, 180. Observations in the Grand Duchy of Baden, 577. Comparative Spraying Experiments with Several Fungicides against Vine Mildew, 793. *See also* Copper, etc.

Funtumia elastica: Uganda Coccidae, 293. In Nigeria, 391.

Fusarium: *Fusarium bulbigenum* on Narcissus Bulbs, 79. Inoculation Experiments on Potatoes with *Fusarium*, 1913, 580. Wilt Disease of Sweet Potato, 687. Potato Diseases in Great Britain, 956.

Fusicladium dendriticum, 959.

Fusicladium Sorghi, 1184.

GALERUCELLA: *G. lineola*, 86. *G. luteola*, 968.

Gall Insects in the Flora of Milan, 486.

Galtonia, 974.

Garden Chafer, 86.

Gastrimargus marmoratus and *G. wahlbergi* on Tobacco, 690.

Germany: First Annual Meeting of the "Deutsche Gesellschaft für angewandte Entomologie", 83. Phytopathological Observations in the Grand Duchy of Baden, 1913, 577. The 1914 Outbreak of Rust on Winter Grain in Bavaria, 795. Occurrence of the Colorado Beetle (*Leptinotarsa decemlineata*) in Germany, 863. Eelworms Injuring Hops in Bavaria, 867. The Life Cycle of *Sitona lineata*, 1076. Contributions to the Cryptogamic Flora of Thuringia, 1183.

Gladiolus, 86.

Glassy star-scale, 797.

Glœosporium Ribis, 577.
Glœopeziza on Tobacco, 861.
Godara comalis in Queensland, 868.
Goniothalamus Elmeri, 787.
Gonitis sabulifera, 84.
Gooseberry: American Gooseberry Mildew recorded in France, 183. Phytopathological Observations in the Grand Duchy of Baden, 1913, 577. Observations on the Life History of the American Gooseberry Mildew (*Sphaerotheca mors-uvae*), 953. The Resistance of Different Varieties of Gooseberries to American Gooseberry Mildew (*Sphaerotheca Mors-uvae*) and the Effect of Treatment with Sulphur, 1068. American Gooseberry Mildew in Italy, 1188.
Gortyna ochracea, 84.
Gossypium, *see* Cotton.
Gramineae: The Occurrence of Rust Spores in the Interior of Wheat and Barley Grains, 73. *Remigia repanda* in Brazil, 803. Notes on the Biology of Leather Jackets in the Pastures of the Avesnois, 964.
Grass moth, *Remigia repanda*, 865.
Great Britain and Ireland: Injurious Insects and other Animals observed in Ireland during the year 1912, 86. Wart Disease of Potatoes, 182. Potato Diseases, 956. Celery Leaf-Spot Disease, 957. Large Narcissus Fly (*Merodon equestris*) and Small Narcissus Fly (*Eumerus strigatus*) injurious to Bulbs, 974.
Great Basin Tent Caterpillar, 1196.
Great Burdock, 286.
Green Fly on Tea in India, 244.
Gryllotalpa vulgaris, 972.
Grind, a Disease of the Vine, 577.
Guava: Uganda Coccidae, 293; in British Guiana, 797.
Guiana: *Tomaspis flavilatera* n. sp. on Sugar Cane in British G., 589. A Fungus Disease of Peppers, 796. The Scale Insects of British G., 797. *Colletotrichum Agaves*, 859. *Marasmius Sacchari*, 860. *Remigia repanda* on Rice, 865.
Guignardia Bidwelli, 958.
Gummosis: Researches on Gummosis and the Effects of Frost on Cherry Trees, 786.
Gymnosporangium: *G. japonicum* on *Juniperus chinensis* 481. *G. Photiniae*, 481. *G. Yamadai*, 578 and 789.

HABRANTHUS, 974.
Habrobracon simenovi, 1193.
Hafersucht, 575.
Haltica pagana in Sweden, *p. 1545*. In Australia, 88.
Hamster, *p. 320*, 577.
Hawaii: *Pseudococcus filamentosus*, 697. Parasites on Tobacco, 1081.
Heliothis, 1193. *H. obsoleta* on Tobacco in Hawaii, 1081.
Heliothrips fasciatus, 585.
Hellula undalis, parasitic on the Cabbage, 868.
Helminthosporium: *H. gramineum*, 388. *H. Oryzae*, 578.
Helopeltis, parasitic on Cacao in Belgian Congo, 1080.
Helops on *Conchylis* and *Polychrosis*, 969.
Hemichionaspis minor on Cotton in British Guiana, 797.
Hemileia in Ceylon, 285. *H. Holarrhenae* on *Holarrhena antidysenterica*, 787.
Hemlock, *Conium maculatum*, 286.
Henderssonia grandimaculans n. sp. on *Chamaerops excelsa*, 788.
Hepialus humuli, 292.
Herse convolvuli, Sweet-Potato Sphinx, on *Ipomoea Batatas*, 973.
Heteronygmia leucogyna on Mahogany, 690.
Heterosporium Yuccae n. sp. on the *Yucca americana*, 788.
Hevea: *Hevea brasiliensis*, Diseases and Pests, Legislation in Ceylon, 285. Coccidae in British Guiana,

797. Order of the French Minister for the Colonies, forbidding the Importation of Hevea Plants into Indo-China, 854. *Cyphella Heveae* and *C. villosa* in Hawaii, 1066. Fungus Diseases of Hevea in the Belgian Congo, 1071. Parasitic Flowering Plants on Para Rubber Trees in Negri Sembilan, 1190.

Hibiscus: Insects injurious to, in Nyasaland Protectorate, 690. Coccidae in British Guiana, 797. *Adoretus vestitus*, 869.

Holarrhena antidysenterica, 787.

Homocidus spp., parasitic on *Platychirus albimanus*, 292.

Hop: *Tylenchus devastatrix* in Bavaria, 867.

Hoplocampa testudinea, 86.

Hovenia dulcis, 789.

Howardia biclavis on *Tabernaemontana Wallichiana* and *H. biclavis* var. *detecta* on *Sapium Jenmanni*, 797.

Hungary: *Tapinostola musculosa*, a Noctuid Moth injurious to Cereals, 192. Recent Work of the Royal Entomological Station, *p. 316*. Observations on Bramble-leaf of Vines, 684. The Conditions determining the Outbreak of Vine Mildew, 857. *Puccinia Menthae* on *Mentha canadensis* var. *piperascens*, 1187.

Hyacinthus: *Merodon equestris* and *Eumerus strigatus* on *Hyacinthus*, 974.

Hyalarcta hübneri, Leaf-Case Moth, 1083.

Hyalopus geophilus, Fungus of Tobacco Seed, 861.

Hydnum coralloides, abundant on the Wood of Deciduous Trees, 962.

Hydrocyanic Acid Gas: Some Factors affecting the Susceptibility of Cucumber Plants to Burning from Hydrocyanic Acid Gas, 191. The Destruction of Woolly Aphis, *Schizoneura lanigera*, and Pear Scale, *Epidiaspis betulae*, by Fumigation with Hydrocyanic Acid, 587.

Hylastes on Clover, 1181.

Hylesinus oleiperda on the Olive in Italy, 1197.

Hylobius abietis on *Pinus Strobus*, 577.

Hymenochaeta tabacina, common on both Conifers and Broad-leaved trees in the United States, 962.

Hypericum: *Remigia repanda* on *H.* in Cuba, 865.

Hypochnus Burnati n. sp. in Switzerland, 1189.

Hypolimnas misippus on Cotton, 690.

Hyponomeuta: *H. malinella* 86 and 400. *H. malinella* and *padella*, 40. *H.* sp. in Sweden, *p. 1545*.

ICERYA: *Novius cardinalis* in France, 85. *I.* sp. in Uganda, 293.

Ichneumon koebelei on *Caradrina reclusa*, 1081.

Imperata arundinacea, 250.

Incappucciamento of Clover, 181, 1181.

India: Tea, 244. *Hemileia Holarrhenae* on *Holarrhena antidysenterica*, 787. *Meliola Memecyli* on *Memecylon edule*, 787. *Sterigmatocystis castanea* on *Punica Granatum*, 960. *Pythium palmivorum* on the Coconut, 961.

Indo-China: Order of the French Minister for the Colonies forbidding the Importation of Hevea Plants, 854. Order of the French Minister for the Colonies, Establishing Regulations concerning Disease in Coconut Plantations, 855. Pests injurious to Rice, 971.

Ink Disease: The Anatomical and Physiological Conditions of Chestnut Branches attacked by Ink Disease, 689.

Insecticides: Chemical Means for the Control of Parasites of Farm Crops, 180, 392, 577, 954. *See also* Arsenic, Copper, Formalin, Hydrocyanic Acid, etc.

Institutions: First Annual Meeting of the « Deutsche Gesellschaft für angewandte Entomologie », 83 Italian Royal Decree Instituting an Independent Phytopathological Observatory at Turin, 856. Work of the Botanical Station at Experimentalfaltet in Sweden, *p. 1548*.

Ipomoea Batatas, *see* Sweet Potato.

Ireland: *see* Great Britain and Ireland.

Ischnaspis: Coccidae in British Guiana, 797.

Italy: Modification of the Laws on Phylloxera Control, 71. The Distribution of Gall Insects in the Flora of Milan, 486. *Polychrosis botrana* and *Conchyliis ambiguella* in Piedmont in 1913, 590. Italian Royal Decree of May 3, 1914, No. 425, Instituting an Independent Phytopathological Observatory at Turin, 856. Emergence from the Soil of the First Larvae of *Phylloxera vastatrix*, 966. Winter Precautions against the Pupae of Vine Moths, *Conchylis ambiguella* and *Polychrosis botrana*, in Piedmont, 969. Mole Crickets (*Gryllotalpa vulgaris*) damaging Rice Fields, 972. The Practical Efficiency of Food Traps in the Control of Vine Moths and the Presence of the Vine Pyralid in Piedmont, 1078. American Gooseberry Mildew, 1188. *Phloeotribus scarabaeoides* and *Hylesinus oleiperda*, Beetles injurious to Olives in the Arezzo District, 1197.

JAMAICA: *Pseudococcus filamentosus*, an injurious Scale, 697.

Japan: Some Japanese Fungi, 481. *Pseudococcus filamentosus*, 697. Parasitic Fungi, 789. Parasitic Fungi in Formosa, 790. Coccidae, 1119 and 1192.

Java: Alang-Alang, 250.

Jasmine: *Tabernaemontana Wallichiana*; *Eugenia paniculata*, 797.

Juniperus: *J. chinensis*, Parasitic Fungi in Japan, 481. *Gymnosporangium Yamadae*, 789. Wood Destroying Fungi in the United States, 962.

KAMERUN: Kroepoek of Tobacco, 288.

Kalu-Kuruminiya, 285.

Karuppu vandu, 285.

Khaya senegalensis, 391, 690.

Koleroga: *Pellicularia Koleroga* on Coffee in Porto Rico, 1185.

Kräuselkrankheit, 288.

Kroepoek of Tobacco, 288.

Kuehneola Fici, 790.

Kupferchlorid, 793.

LACHNODIUS GREENI n. sp. in Madagascar, 695.

Lachnosterna spp., 864.

Ladybirds: Destruction of *Conchylis* Larvae by Ladybirds, 586.

Lagria sp. on Cotton and Maize, 391 and 690.

Landolphia, Host of *Pseudococcus filamentosus*, 697.

Laphygma frugiperda, Rice Caterpillar, 865.

Large Bagworm, *Clania variegata*, 1195.

Large Narcissus Fly, *Merodon equestris*, 974.

Larix occidentalis: Wood-destroying Fungi in the United States, 962. *Fomes putearius* and *Trametes setosus*, 1075. *Tetropiura gabrieli* var. *crawshayi*, 1198.

Lasioderma sericorne on Tobacco, 1081.

Laykoschwefel, 577.

Leaf-blight of Coffee, 1185.

Leaf Case Moth, 1083.

Leaf-curl: Of Tobacco, 288. Of Potatoes, 577, 580, 683, 858.

Leaf-miner of Camphor, 1195.

Lecaniodiaspis dendrobii, 797.

Lecanium: Uganda Coccidae, 293, 798. *Lecanium pseudomagnoliarum*, 1192.

Legislative and Administrative Measures: Modification of the Laws on Phylloxera Control in Italy, 71. The Importation of Cotton Seed into Algeria; Decree of the President of the French Republic, fixing the conditions of, 179. Diseases and Pests Legislation in Ceylon, 285. The Recommendations of the International Phytopathological Conference, 384. Law Placing a Sum at the Disposal of the Minister of Agriculture of France for the Control of Voles, 385. Legislative Measures Concerning Plant Diseases in Egypt, 479. Observations and Researches on "Dörrfleckenkrankheit", Dry-spot Disease of Oats, 575. Decree of the President of the French Republic, April 18, 1914, relating to the Importation into Algeria of Plants other than Vines and Resin-yielding, 681. Act allotting 500 000 Francs to the Minister of Agriculture of France for the Control of Voles, 682. Decree of the President of the French Republic, June 9, 1914, Authorizing the Introduction into France of Plants other than Vines through the Dijon Customs House. 853. Order of the French Minister for the Colonies, June 19, 1914, forbidding the Importation of Hevea Plants into Indo-China, 854. Order of the French Minister for the Colonies, June 19, 1914, Establishing Regulations Concerning Disease in Coconut Plantations in Cochin-China and the Annam and Cambodia Protectorates, 855. Italian Royal Decree of May 3, 1914 (No. 425), Instituting an Independent Phytopathological Observatory at Turin, 856. Decree of the Governor of the Colony of Eritrea, dated 13 July 1914, (No. 1026), concerning the Protection of Plants, 1064.

Leistes guianensis, 865.

Lenzites sepiaria, Wood-destroying Fungi, 962.

Lepidiota pinguis on Camphor, 1195.

Lepidium Draba, 286.

Lepidoptera: Insects injurious to Crops in the Nyasaland Protectorate, 690.

Lepidosaphes beckii on *Citrus* in British Guiana, 797. In Ceylon, 1084.

Leptinotarsa decemlineata, 863.

Leptocorisa varicornis and *L. acuta* on Rice in Conchichina, 971.

Leptosphaeria Tritici on the Leaves of Wheat, 1184.

Lesser Bud-Moth, 804.

Lesser Burdock, 286.

Leucena glauca, 250.

Lime-Sulphur Solution, The Preparation of, 1077.

Limnerium blackburni on *Phthorimaea operculella*, 1081.

Lippia nodiflora in the Argentine Republic, 623.

Locusts: Destruction in Turkestan, 393. Legislative Measures in Egypt, 479.

Lophodermium brachysporum in Belgium, 76.

Loranthus, Host of *Pseudococcus filamentosus*, 697.

Lucerne: *Agromyza pusilla*, 87. *Dichomeris ianthes*, *Catopsilia crocale* and *Catachrysops pandava* in Ceylon, 1194.

Lygocerus, 800.

Lygus pratensis, 692.

Loyneiia clerkella, 577.

MACROSPORIUM SOLANI in Belgium, 76. In Tomato Seed, 1067.

Madagascar: *Lachnodius greeni* n. sp., Coccidae on Coffee, 695.

Madiola lateritia in the Argentine Republic, 623.

Magnolia: *Microdiplodia solitaria* n.

sp., on *Magnolia grandiflora*, 788. Coccidae in British Guiana, 797.
Mahogany, *see Khaya senegalensis*.
Makabo, *Colocasia antiquorum*, 288.
Malachius bipustulatus, 969.
Malacidschwefel, 577.
Malacosoma fragilis, Great Basin Tent Caterpillar, 1196.
Malpighia: Coccidae in British Guiana, 797.
Maize: Insects Injurious to, in Nigeria, 391. On the Occurrence of *Aphis maidis* in West Africa, 487. Insects Injurious to, in the Nyasaland Protectorate, 690.
Mangifera indica: *Pseudococcus filamentasus*, 697.
Mango Shield Scale, *Coccus mangifera*, 797.
Mango snow scale, *Aulacaspis rosae* 797.
Marasmius Sacchari on the Sugar Cane in British Guiana, 860.
Marssonia Rosae, 1073.
Maura bolivari on Tobacco, 690.
Mauritius. *Pseudococcus filamentosus*, 697.
Mealy shield-scale, 797.
Megilla maculata on *Remigia repanda*, 865.
Melampsora Lini on *Linum angustifolium*, 788.
Melilotus parviflorus in the Argentine Republic, 623.
Meliola Memecyli on *Memecylon edule*, 786.
Melopius discolor parasitic on *Diacrisia maculosa*, 391.
Memecylon edule: *Meliola Memecyli*, 787.
Mentha canadensis var. *piperascens* in Hungary, 1187.
Merodon equestris, Large Narcissus Fly, 974.
Mesochorus sp., 400.
Metallic Flea Beetle (*Haltica pagana*), a New Pest of Strawberries in Victoria (Australia), 88.
Metarrhizium Anisopliae, 869.
Microbasidium Sorghi on the living leaves of *Sorghum saccharatum*, 1184.
Micrococcus nigrofaciens as Cause of an Infectious Disease of the Larvae of *Lachnosterna* spp. in the United States and in Portorico, 864.
Microdiplodia solitaria n. sp. on *Magnolia grandiflora*, 788.
Microplites rufiventris n. sp., parasitic on *Caradrina exigua*, 1193.
Microsphaera Yamadai on *Hovenia dulcis* in Japan, 789.
Mildew: Resistance of Hybrid Direct-Bearer Vines to Mildew, 686. *Cicinnobolus* sp. Parasitic on Apple Mildew (*Oidium farinosum*), 75. American Gooseberry Mildew recorded from France, 183. Phytopathological Observations in the Grand Duchy of Baden 1913, 577. Observations on the Life-History of the American Gooseberry-Mildew, 953. Contribution to the Mycological Flora of Servia, 1184. The Conditions determining the outbreak of Vine Mildew in Hungary, 857.
Millet, Insects Injurious to, in the Nyasaland Protectorate, 690.
Monoloxis lavagnei n. sp. parasitic on *Sinoxylon sexdentatum*, 189.
Morphacris fasciatus on Tobacco, 690.
Moss: The destruction of Insects Injurious to Fruit Trees and Vines by Means of "Carragaheen", or "Pearl Moss" Jelly, 488.
Mucuna pruriens, 690.
Mulberry: Uganda Coccidae, 293. *Phleospora Mori* on Leaves of *Morus alba*, 791. Studies on the Chemical Composition of Mulberry Trees in Japan, 907. Studies on the Mulberry Leaf, 1099.
Musa: Coccidae in British Guiana, 797.
Myelois: Pod Borer, 391.
Myrtus italica, 788.

Mytilaspis citricola on *Citrus*, 574.
Myzus cerasi, 76.

NAPICULADIUM ARUNDINACEARUM, 481.
Narcissus: *Fusarium bulbigenum*, 79. *Eumerus strigatus* and *Merodon equestris*, 974.
Nasturtium: *Bacterium aptatum* n. sp. in the United States, 483.
Natal: *Herse convolvuli* on the Potato, 973.
New South Wales: *Ranunculus sceleratus*, 187. Peach Tip Moth injurious to Peaches and other Fruit Trees in New South Wales, 1082.
New Zealand: Resistance of Potatoes to Blight, *Phytophthora infestans*, in New Zealand, 791.
Nicotiana, *see* Tobacco.
Nicotine: Recent Work of the Royal Entomological Station of Hungary, *p. 361*. Chemical Control by means of, 180.
Nigeria: Entomological Pests and Problems of Southern Nigeria, 391.
Novius cardinalis, 85.
Nsambyia (*Markhamia platycalyx*), 293.
Nuphar luteum, 1184.
Nyasaland Protectorate: Injurious Insects, 690.

OAK: Diseases and Pests in Belgium in 1911 and 1912, 76. *Monolexis lavagnei* n. sp. parasitic on *Simoxylon sexdentatum*, 189. *Polyporus dryades*, Root Parasite of the Oak in the United States, 485. Wood-destroying Fungi, 962. Coccidae in Japan, 1192. *Malacosoma* sp. in California, 1196.
Oats: *Puccinia graminis*, 76. *Tylenchus devastatrix* and *Oscinis frit*, 86. Observations and Researches on "Dörrfleckenkrankheit" (Dry-spot Disease) of Oats, 575.
Ochroe, 797.
Ochropsora Sorbi on *Prunus sinensis*, 790.
Oedaleus citrinus on Tobacco, 690.
Oenophthira pilleriana, see Tortrix.
Olive: Parasites of the Fruit Fly in Africa, 190. *Tetrastichus gentilei*, 585. A Nematode Parasite of the Olive Weevil (*Rhynchites ruber*), 693. *Ceuthospora phacidioides* var. *Oleae*, 788. *Phloeotribus scarabaeoides* and *Hylesinus oleiperda*, 1197.
Omphalia flavida, 78.
Onions: *Eumerus strigatus* in Great Britain and Ireland, 974.
Oospora (*Oidium*) *lactis* var. *Solani*, 688.
Ootheca mutabilis on Cotton, 690.
Ophiobolus: *O. graminis* and *O. herpotrichus*, 291.
Opius, 190.
Opuntia elongata in British Guiana, 797.
Orange snow scale, *Chionaspis citri*, 797.
Orchis sp. in France, 862.
Orobanche: On the Germinating Power of Seeds of *Orobanche crenata* after passing through the Digestive Tracts of Cattle and after Fermentation in the Dung, 81.
Orthezia: Coccidae in British Guiana, 797. In the Seychelles, 798.
Oryctes rhinoceros, 285.
Oscinis: *O. frit*, 86 and 575. *O. trifolii* syn. *Agromyza pusilla*, 87.
Otiorrhynchus: *O. picipes* 86. *O. sulcatus*, 1085.
Oxycarenus dudgeoni on Cotton, 391.
Oxyrhepes procera on Tobacco, 690.

Pachytoma gigantea on *Cypressus*, 690.
Panicum: *P. Colonum* in the Argentine Republic, 623. *P. muticum* in British Guiana, 865.
Papaver Rhoeas and *P. hybridum* in Egypt, 963.
Papilio lankesware on Camphor, 1195.
Para grass, *Panicum muticum*, 865.
Paragus borbonicus on Cotton, 391.

Parasa vivida on Coffee, 690.
Parlatoria zizyphus parasitic on Citrus Fruits, 797.
Pasta Caffaro, 793.
Pastures: Notes on the Biology of Leather Jackets, *Tipula oleracea*, in the Pastures of the Avesnois, 964.
Paxillus atratomentosus, 962.
Peach Tip Moth injurious in New South Wales, 1082.
Peas: *Thripoctenus brui* n. sp. a Chalcid Parasite of *Frankliniella robusta* injurious in France, 585.
Pears: Diseases and Pests in Belgium in 1911-12, 76. Insects injurious to, in Ireland, 86. *Epidiaspis betulae*, 587. *Bacillus amylovorus*, 952. *Venturia pirina*, 959.
Peelna, 1081.
Pellicularia Koleroga injurious to Coffee in Porto-Rico, 1185.
Pemphigus trifolii on Clover, 1181.
Pennisetum purpureum: Uganda Coccidae, 293.
Pepper: A Fungus Disease of Peppers (*Capsicum* spp.): *Colletotrichum nigrum*, 796.
Peridermium Strobi on *Pinus Strobus*, 577.
Perocid, 793.
Periplaneta americana: *Micrococcus nigrofaciens* on *P. a.* 864.
Peronosclerospora, 481.
Persea gratissima, see Avocado.
Pestalozzia funerea, 1186.
Phaedon cochleria in Sweden, *p.* 1545.
Phenacoccus azaleae, 1192.
Philippines: New Fungi, 787.
Phillyrea latifolia, 788.
Phlegethontius quinquemaculata, 1081.
Phleospora Mori on *Morus alba*, 790.
Phleum pratense, 292.
Phloem: Leaf-Curl in Potatoes and its connection with Necrosis of the Phloem, 683.
Phloeothrips oleae, 585.
Pholiota adiposa in the United States, 962.
Phoma, sp., 80.
Phthorimaea: *P. heliopa* on Tobacco, 690. *P. operculella* on Tobacco in Hawaii, 1081.
Phycomycetes, 789.
Phyllobius oblongatus and *P. viridiaeris* 86.
Phyllocnistis citrella, 1084.
Phyllocoptes vitis, 577.
Phyllosticta, 181, 1184.
Phyllotreta sp. in Sweden, *p.* 1545.
Phylloxera: Modification of the Laws on Phylloxera Control in Italy, 71. Phytopathological Observations in the Grand Duchy of Baden, 577. Experimental Demonstration of a Difference in Biological Race between the Phylloxera of the South of France and that of Lorraine: *Peritymbia* (*Phylloxera*) *vitifolii pervastatrix*, 799. *Phylloxera vastatrix*, 966.
Phytophthora: *P. Faberi*, 285. *P. infestans* on *Solanum Melongena*, 789. In England, 956. New Era, 966. On Cacao, 1072.
Picea: *Hydnum coralloides* on *P. Engelmanni*, 962. *Fomes putearius* in the United States, 1075.
Pineapple: Injurious Scales from the Seychelles, 798. *Aspidiotus bromeliae*, 967.
Pinnaspis buxi on Palms and on *Monstera deliciosa* and *Anthurium magnificum* in British Guiana, 797.
Pinus: *Monolexis lavagnei* n. sp. (Braconidae) parasitic on *Sinoxylon sexdentatum* on Vine Shoots, 189. Phytopathological Observations in Baden, 1913, 577. *Rehmiellopsis conigena* n. sp., 788. *Fomes putearius* and *Trametes setosus* in the United States, 1107. A Contribution to the Morphology and Life History of *Pestalozzia funerea* Desm., 1186.
Pithecolobium Saman host of *Pseudococcus filamentosus*, 697.
Pityogenes: *Monolexis lavagnei* on, 189.

Pityophthorus: *Monolexis lavagnei* on, 189.
Plantago, 964.
Plasmodiophora, 184, 577.
Platychirus albimanus parasitic on *Pterocallis tiliae*, 292.
Plenodomus destruens on the Potato, 482.
Pleospora trichostoma, Experiments on Control on Barley. 388.
Pleurotus serotinus, Wood-destroying Fungi in the United States, 962.
Plusia orichalcea and *P. chalcites* on Cotton, 690.
Poa: Biology of, 964. *P. annua* and *P. pratensis*, 292.
Podosphaera tridactyla on Leaves of *Prunus Armeniaca*, 1184.
Poliporus spp. in the United States, 962. *P. dryades*, 485.
Polvillo, 1079.
Polychrosis botrana, *see Eudemis*.
Polyphylla fullo, *p. 299*.
Pomegranate: *Sterigmatocystis castanea* in India, 960.
Pongamia glabra, host of *Pseudococcus filamentosus*, 697.
Populus: Wood-destroying Fungi in the United States, 962.
Porto-Rico: *Micrococcus nigrofaciens*, 864. The Koleroga on Coffee, 1185.
Potato: Diseases and Pests in Belgium in 1911-12, 76. *Psylliodes affinis*, 86. *Chrysophlyctis endobiotica*, 182. Phytopathological Observations in Baden, 577. *Fusarium*, 580. Blattrollkrankheit, 683. *Phytophthora infestans*, 791. In Austria, 858. *Leptinotarsa decemlineata*, 863. In England, 956. New Era, 996. In Australia, 1070. In Sweden, *p. 1545*.
Powdery scab, 1070.
Praon sp., 800.
Prodenia litura: The Law No. 13, of April 17, 1905 indicating destructive measures to be taken against *Prodenia litura*, Cotton Worm in Egypt, 479.
Prunella vulgaris, 724.
Prunus: Wood-destroying Fungi in the United States, 962. *Prunus Mume* in Japan, 789.
Pseudococcus: Coccidae in British Guiana, 797. *P. filamentosus*, 697. *P. virgatus* on Cacao, 391. In Ceylon, 1084.
Pseudomonas palichromigena, 688.
Pseudotsuga: Wood-destroying Fungi in the United States, 962. *Fomes putearius* and *Trametes setosus*, 1075.
Psila rosae, 86.
Pterocallis tiliae, 292.
Pteromalus, parasitic on *Aphis evonymi*, 800. On *Lasioderma serricorne* 1081. On Cloverl, 1180.
Pteronycta fasciata on Cotton, 690.
Puccinia: The Occurrence of Rust Spores in the Interior of Wheat and Barley Grains, 73. Wintering of Cereal Rusts in the Uredo Stage, 579. *Epimedium macranthum* on *Puccinia Epimedii* in Japan, 481. *P. glumarum*, 73, 577, 795. *P. graminis*, 73. *P. Malvacearum*, 290. *P. Triticina* on *Triticum vulgare* in Japan, 789. *P. Menthae* on *Mentha canadensis* var. *piperascens* in Hungary, 1187.
Pueraria phaseoloides: *Cercospora Puerariae* on *P. ph.*, 787.
Pulvinaria, host plants of, in Uganda, 293. In British Guiana, 797. *Pulvinaria citricola* in Japan, 1192.
Punica Granatum, *see* Pomegranate.
Pyrus: Wood destroying Fungi in the United States, 962. *Ochrospora Sorbi* on the *P. sinensis*, 790.
Pythium de Baryanum and *Rhizoctonia* sp. in the United States, 794.
Pythium palmivorum in India, 961.

QUARUM, 963.
Quercus: Wood-destroying Fungi in the United States, 962. *Q. glanduli-*

fera in Japan, 789. *Q. lanuginosa*, 788. *Q. pubescens* and *Q. sessiflora*, 1184.

Rabbits: Partial Damages of Frost on Winter Cereals resembling Damage by Wild Animals, 72. Observations in the Grand Duchy of Baden 1913, 577.
Rami-rami, parasitic on Maize, 391.
Ranunculus: *R. Guilelmi-Jordani*, 390. *R. sceleratus*, 187, 390.
Rape: The Serpentine Leaf-miner, *Agromyza pusilla*, 87.
Raphanus Raphanistrum, 724.
Rata Kuraminiya, 285.
Recurvaria nanella in the United States, 804.
Red-headed fungus, 797.
Rehmiella ulmicola, 578.
Rehmiellopsis conigena n. sp. on *Pinus*, 788.
Remigia repanda on Rice and Sugar cane in British Guiana, 803, 865.
Réunion: Coffee, 976.
Rhizoberlesia trifolii n. g. and n. sp. on Clover, 1181.
Rhizoctonia, Damping off, 794.
Rhopalosiphum ribis, 86.
Rhynchites ruber, 693.
Rhynchophorus segnaticollis, 285.
Rice: Insects injurious in the Nyasaland Protectorate, 690. New Fungi, 787. The Scale Insects of British Guiana, 797. The Grass Moth (*Remigia repanda*), a Pest of Sugar Cane, Rice and Paragrass in British Guiana, 865. Withering of the Panicle in Rice, 951. Principal Pests of Rice in Indo-China, 971. The Mole Cricket, *Gryllotalpa vulgaris*, damaging Rice Fields in Italy, 972.
Rice caterpillar, *Laphygma frugiperda*, 865.
Ringkrankheit, 577.
Ripersia sp. on the Sugar Cane in British Guiana, 797.
River Birch: *Agromyza pruinosa* (Diptera) on River Birch (*Betula nigra*) in *America*, 591. Wood-destroying Fungi in the United States, 962.
Rodents, *p. 320.*
Roestelia sp. in Japan, 481.
Rosenkäfer, 869.
Rose Slug-Caterpillar (*Euclea indeterminа*) in the United States, 396.
Roses: *Typhlocyba rosae*, 76. *Euclea indetermina*, 396. *Adoretus vestitus*, 869. *Marssonia Rosae*, 1073.
Rumex Acetosella, 724.
Russia: *Fagopyrum tataricum* as a Weed among Buckwheat in Volhynia, 82. New Species of *Aphelinus* Parasitic on injurious Aphids, 891.
Rust: The Occurrence of Rust Spores in the Interior of Wheat and Barley Grains, 73. Wintering of Cereal Rusts in the Uredo Stage, 579. On the Presence of Sori and Mycelium of Rusts in the Caryopses of Cereals, 685.
Rye: Experiments on the Control of *Urocystis occulta* (Wallr. Rabenh.), 389.

Saffron: Phytopathological observations in the Grand Duchy of Baden 1913, 577.
Sahlbergella: *S. singularis* on Cacao, 1072 and 1080.
Saissetia: Coccidae in British Guiana, 797.
Salix: Wood-destroying Fungi in the United States, 962.
Salpingogaster nigra, 188.
Samoa: *Adoretus vestitus*, 869.
Sapium: Coccidae in British Guiana, 797.
Sceliolinae on *Aphis evonymi*, 800.
Schizoneura lanigera on Apple in Ireland, 86. Fumigation with Hydrocyanic Acid, 587.
Schkuria bonariensis in the Argentine Republic, 623.
Schoenobius bipunctiferus on Rice in Cochinchina, 971.

Schwefelaluminiumpatronen, 577.
Scilla : Merodon equestris on *Sc.*, 974.
Sclerospora Sacchari, 481.
Sclerotinia cinerea : Cladosporium episclerotiale, 788.
Scabicia pustulata : Monolexis lavagnei, 189.
Scolecotricum Graminis, 575.
Scymnus includens on *Pseudococcus filamentosus*, 697.
Selenaspidus articulatus on *Citrus* and on *Coffea liberica*, 797.
Septogloeum Anemones, 578.
Septoria Petroselini var. *Apii*, 957. *S. Nupharis* n. sp. on *Nuphar luteum* in Servia, 1184.
Sereh : Comparative Water Absorption of Sugar Cane Plants when Suffering from Sereh Disease, 632.
Serpentine Leaf Miner, *Agromyza pusilla*, 87.
Servia : Contribution to the Mycological Flora, 1184.
Sesamia inferens on Rice in Cochinchina, 971.
Sevappu vandu, 285.
Seychelles : Injurious Scales, 798.
Shallots : *Eumerus strigatus* in Great Britain and Ireland, 974.
Shield-scale fungus, 797.
Sida rhombifolia in the Argentine Republic, 623.
Sinapis arvensis, 286. 583.
Sinoxylon sexdentatum : Monolexis lavagnei, 189.
Sisal : *Acheta morio*, 194. In Africa, 785. Uganda Coccidae, 797. *Colletotrichum Agaves*, 859.
Sitona lineata in Germany, 1079.
Sitotroga cerealella on Rice in Cochinchina, 971.
Slender or Shore Thistle, in Tasmania, 286.
Small Narcissus Fly, *Eumerus strigatus*, 974.
Soap, Chemical Control by means of, 180.
Sorghum Saccharatum, 1184.
Spain : Black Rot, *Guignardia Bidwellii*, 958.
Spalgis epius on *Pseudococcus filamentosus*, 1084.
Sphaerotheca Humuli in Servia, 1184.
Sphaerotheca mors-uvae : Cicinnobolus sp., 75. On *Ribes* in Belgium, 183. In the Grand Duchy of Baden, 577. Biology, 953. The Resistance of Different Varieties of Goosberries, 1068. In Sweden, *p. 1546*. In Italy, 1188.
Spondylocladium atrovirens on Potato, 1070.
Spongospora : S. Solani 956. *S. subterranea*, 1070.
Sporotrichum globuliferum on *Blissus leucopterus*, 588.
Spraying of Fruit Trees with Nitrate of Soda, 638.
Stereum hirsutum on *Abies grandis* and *Tsuga heterophylla* and *S. purpureum* on *Populus, Salix, Larix, Betula*, 962.
Sterigmatocystis castanea on *Punica Granatum* in India, 960.
Stigmella dryophilla on *Quercus lanuginosa*, 788.
Stilbum flavidum parasitic on Coffee, 78.
Stinking mayweed, 286.
Straits Settlements : Parasitic Fungi, 1066.
Streak Disease, 185.
Suana concolor on Camphor, 1195.
Sugar Cane : Cultivation in the Argentine Republic, *p. 424*. Some Japanese Fungi on, 481. *Tomaspis flavilatera*, n. sp. (Hemiptera) on Sugar Cane in British Guiana, 589. Comparative Water Absorption of Sugar Cane Plants when Suffering from Sereh Disease, 632. Coccidae in British Guiana, 797. The " New Disease " or " Dry Disease " of the Sugar Cane : *Marasmius Sacchari*, 860. A New Sugar Cane Aphid, (*Aphis bituberculata*) in Louisiana,

866. *Euxesta chavannei* and its Relation to the Sugar Cane Disease caused by *Bacillus Sacchari*, in the Province of Tucuman, Argentine, 1079.

Sulphate of Copper: Commercial Sulphate of Copper and the Determination of the Copper in it, 792.

Sulphate of iron, 577.

Sulphur, Chemical Control by means of, 180.

Sweden - Wart Disease of Potato, 182. Work of the Entomological Section of the Swedish Central Agricultural Experiment Station, during the years 1907-14. The Control of Plant Diseases in, *p.* 1546.

Sweet Peas; Streak Disease of Sweet Peas, 185.

Sweet Potato: *Plenodomus destruens*, "Foot Rot" of Sweet Potatoes, 482. *Fusarium hyperoxysporium* and *F. Batatatis* in the United States, 687. Sweet Potato Sphinx (*Herse convolvuli* ?) in Natal, 973.

Syagrus calcaratus on Cotton, 391.

Sylepta derogata on Cotton, 391, 690.

Sylpha atrata, 577.

Sympha agromyzae on *Agromyza pruinosa*, 591.

Synchytrium endobioticum, *Chrysophlyctis endobiotica*, 182.

Syringa vulgaris, 797.

Syrphid Fly: Life-History of Syrphid Fly Predaceous on Froghopper Nymphs, 188.

Syrphus sp. on Cotton, 391.

Tabernaemontana Wallichiana, 797.

Tachardia: *T. decorella* in Uganda, 293. *T. lacca* in British Guiana, 869.

Tapinostola musculosa in Hungary, 192.

Tarnished plant-bug, 692.

Tasmania: Injurious Plants, 286. *Carduus pycnocephalus*, Slender or Shore Thistle, 287.

Tea: The Selection of Tea, 244. In Ceylon, 285. A List of Uganda Coccidae and their Food- Plants, 293. Insects injurious in Nyasaland Protectorate, 690. *Sterigmatocystis castanea*, 960.

Teazel, 286.

Terminalia Catappa: *Aspidiotus destructor* in British Guiana, 797. *T. littoralis*, 869.

Tesselated shield-scale, 797.

Tetranychus: in Sweden, *p.* 1545. *T. bioculatus* on Camphor in Ceylon, 1195. *T. mytilaspidis* on Citrus in Ceylon, 1084.

Tetrastichus gentilei parasitic on *Phloeotrips oleae*, 585.

Tetropium gabrieli var. *crawshayi* on Larch in England, 1198.

Thanaton, *p.* 317.

Theobroma Cacao, *see* Cacao.

Thielaviopsis ethaceticus, 285.

Thripoctenus brui n. sp. parasitic on *Frankliniella robusta* in France, 585.

Thrips, *Cryptothrips floridensis* Watson, on Camphor, *Cinnamomum Camphora*, 1195. On Olive, 693.

Thuya: Wood-destroying Fungi in the United States, 693.

Tilletia: *T. Caries*, 577. *T. horrida* on Rice in Cochinchina, 971.

Tipula oleracea: Notes on the Biology of Leather Jackets (*Tipula oleracea*) in the Pastures of the Avesnois (Nord, France), 964.

Tmetocera ocellana, 804.

Tobacco: On "Kroepoek" of Tobacco in Kamerun, 288. *Orobanche ramosa*, 577. Insects injurious in Nyasaland Protectorate, 690. Experiments in Harvesting Tobacco Leaves, 742. Two New Species of Fungi in Tobacco Seedbeds: *Gloeopeziza turricula* and *Hyalopus geophilus*, 861. Insects injurious to, Tobacco in Hawaii, 1081.

Tomaspis: *T. flavilatera* n. sp. in

British Guiana, 589. Froghopper, 188.

Tomatoes: Black Spots on Tomatoes caused by *Cladosporium herbarum*, 688. The Presence of the Hibernating Mycelium of *Macrosporium Solani* in Tomato Seed, 1067. Blossom-End Rot of Tomatoes, 1182.

Tortrix: Peach Tip Moth, injurious to Peaches and other Fruit Trees in New South Wales, 1082. *T. pilleriana*, 577, *T. ribeana*, 86.

Toxoptera: on the Citrus in Ceylon, 1084. *T. graminum*, 294.

Trametes: in the United States, 962. *T. setosus* n. sp. and *Fomes putearius*, 1075.

Tremella Koreaensis, 481.

Trichogramma pretiosa, 1081.

Trifolium pratense, *see* Clover.

Trioxys, 800.

Triplasis purpurea, 588.

Tropaeolum: *Bacterium aptatum* n. sp. 483. *T. majus*: *Uromyces Tropaeoli*, 1184.

Tsuga heterophylla: Wood-destroying Fungi, 962.

Tulipa: *Merodon equestris*, 924.

Turkestan: Destruction of Locusts, 393. New Species of Hymenopterous Parasites on *Heliothis armigera* and *Caradrina exigua* in Russian Turkestan, 1193.

Turnips: *Ceuthorrhynchus pleurostigma*, 86. In the Grand Duchy of Baden, 577. *Godara comalis*, 868.

Twig-girdler on Camphor, 1195.

Tylenchus devastratrix, 86, 867.

Typhlocyba comes, 398. *T. rosae*, 76.

Typhula Betae, 434.

Uganda: Coccidae, 293. *Dirphya* (*Nitocris*), *princeps* on Coffee, 696. Coffee, 824.

United States: The Control of the Codling Moth in the Sacramento Valley, California, 399. *Bacterium aptatum* n. sp. Injurious to the Leaves of Sugar Beets and Nasturtium, *Tropaeolum*, 483. *Polyporus dryadeus*, Root Parasite of the Oak, 485. *Cylindrosporium Juglandis* injurious to the Leaves of Walnut in Alabama, 582. The Chinch Bug, *Blissus leucopterus*, injurious to Cereals in Kansas, 588. Wilt Disease of Sweet Potato, 687. The Control of Damping-off Disease in Plant Beds, 794. Two New Genera of Hymenoptera Parasitic on *Ectoedemia*, 802. Lesser Bud-Moth *Recurvaria nanella* on Apples in Michigan, 804. *Coccus citricola*, a New Scale infesting Citrus Trees in California, 805. *Micrococcus nigrofaciens* as Cause of an Infectious Disease of the Larvae of *Lachnosterna* sp., 864. A New Sugar Cane Aphid, *Aphis bituberculata* in Louisiana, 866. The Status of Investigational Work on Pear and Apple Blight, 952. A Contribution to our Knowledge of Apple Scab, 959. Rotting of Pomegranates in India: *Sterigmatocystis castanea*, 960. Wood-destroying Fungi which Grow on Both Coniferous and Deciduous Trees, 962. Field Studies on the *Endothia* Canker of Chestnut in New York State, 1074. Two New Wood-destroying Fungi: *Fomes putearius* and *Trametes setosus*, 1075. Outbreak of *Malacosoma fragilis* in California, 1196.

Urania-Grün, 577.

Uredo: Wintering of Cereal Rusts in the Uredo Stage, 579.

Urocystis occulta, 76, 389.

Uromyces Tropaeoli sp. nov. on the Living Leaves of *Tropaeolum majus*, 1184.

Uropyxis Fraxini on *Fraxinus longicuspis* in Japan, 789.

Uruguay: Decree Placing *Mytilaspis citricola* (= *Lepidosaphes beckii*) amongst Notifiable Insects, 574.

Ustilaginoidea virens on Rice in Cochinchina, 971.
Ustilago: U. Maydis and *U. nuda*, 74. *U. Rottboeliae*, 481.

VALLOTA: *Merodon equestris*, 974.
Vanessa cardui, 84.
Vanilla in Madagascar, 635.
Vaporite, *p. 1412*.
Venturia inaequalis, 959.
Vigna Catjang: Agromyza pusilla, 87.
Vine: Modification of the Laws on Phylloxera Control in Italy, 71. The Rotting of Bunches of Grapes produced by *Phoma* sp. in Algeria, 80. *Monolexis lavagnei* n. sp., Braconid, parasitic on *Sinoxylon sexdentatum* on Vine Shoots, 189. Vine Caterpillars in Hungary, *p. 318*. On the Pathological Significance of Endocellular Fibres in the Tissues of the Vine, 289. The Grape Leaf-Hopper (*Typhlocyba comes*) in New York State, 398. On the Pathological Significance of Endocellular Threads in the Tissues of the Vine, 480. The Destruction of Insects Injurious to Vines by Means of Carragaheen or Pearl Moss Jelly, 488. Recent Work of the Royal Hungarian Central Ampelological Institute of Budapest, 529. The Presence of Endocellular Fibre in the Tissues of the Vine and of other Dicotyledons, 576. Phytopathological Observations in the Grand Duchy of Baden, 577. Relation between the Larvae of Vine Moths and the Weeds of Vineyards, 584. *Conchylis ambiguella* and *Polychrosis botrana* in Italy, 590. In Hungary, 684. Control of the Second Generation of Vine Moths by means of Protecting Envelopes, 694. Comparative Spraying Experiments with Several Fungicides against Vine Mildew, 793. Experimental Demonstration of a Difference in Biological Race between the Phylloxera of the South of France and that of Lorraine, 799. The Conditions Determining the Outbreak of Vine Mildew in Hungary, 857. Black Rot of Grapes (*Guignardia Bidwellii*) in Spain, 958. The Emergence from the Soil of the First Larvae of *Phylloxera vastatrix* in Italy, 966. The Practical Efficiency of Food Traps in the Control of Vine Moths and the Presence of the Vine Pyralid in Piedmont, 1078. *Otiorrhyncus sulcatus* attacking Vines in the Ile d'Oléron, France, 1085. Fungi in Servia, 1185. *Hypochnus Burnati*, a New Fungus on the Vine in Switzerland, 1189. *Lecanium magnoliarum* in Japan, 1192.
Viper's bugloss, 286.
Voles: The Control of Voles in the Val di Chiana, Italy, 89. Recent Work of the Royal Entomological Station of Hungary, *p. 316*. A Law Placing at the Disposal of the Minister of Agriculture of France from the Budget of 1913 the Sum of 750 000 frs. for the Control of Voles, 385. Act allotting 500 000 Francs to the Minister of Agriculture of France for the Control of Voles, 682.

WALKERIANA sp. on the Citrus, 1084.
Water hyacinth, *Eichhornia crassipes*, 798.
Walnut: *Cylindrosporium Juglandis* in Alabama, 582. *Sterigmatocystis castanea* in the United States, 960.
Wart Disease of Potatoes: *Chrysophlyctis endobiotica* (*Synchytrium endobioticum*), 182.
Weeds: A Poisonous Buttercup (*Ranunculus sceleratus* L.) in New South Wales, 187. List of Proclaimed Noxious Weeds in Tasmania, 286. *Ranunculus sceleratus* and *R. Guilelmi-Jordani* in Egypt, 390. Phytopathological Observations in the

Grand Duchy of Baden, 1913, 577. Experiments on the Destruction of Charlock (*Sinapis arvensis*) by Mechanical and Chemical Means, 583. Relation between the Larvae of Vine Moths and the Weeds of Vineyards and other Plants, 584. Impurities in Seeds in Victoria, Australia, 724. *Papaver Rhoeas* and *P. hybridum* in Egypt, 963.

Wheat : The Occurrence of Rust Spores in the Interior of Wheat and Barley Grains, 73. *Puccinia glumarum*, 76. *Oscinis frit*, 86. In Egypt, 387. Phytopathological Observations in the Grand Duchy of Baden, 577. *Bibio hortulanus*, 691. *Puccinia Triticina*, 789. The 1914 Outbreak of Rust on Winter Grain in Bavaria, 795. The Contortion and Breaking of Wheat Straw, 1065. Contribution to the Mycological Flora of Servia, 1184.

White grubs, 864.

White Weed, *Lepidium Draba*, 286.

Wild onion, 286.

Winsonia in British Guiana, 798.

Wood-destroying Fungi in the United States and in Europe, 963.

Wurzelbrand, 577.

XANTHIUM SPINOSUM, 286.

Ximenia americana : *Pseudococcus filamentosus*, 697.

Xyleborus on Tea and on Coffee, 1195. *X. fornicatus*, 285.

Xylococcus napiformis on *Quercus serrata*, 1192.

Xylonites praeustus : *Monolexis lavagnei*, 189.

Xylopertha sp., 1195.

YELLOW-HEADED Coffee Borer, 696.

Yponomeuta, *see Hyponomeuta*.

Yucca americana : *Heterosporium Yuccae* n. sp., 788.

ZABRUS TENEBRIOIDES, *p. 316*.

Zaghlil, 963.

Zaghlul, *Ranunculus*, 390.

Zamia : *Aspidiotus ficus*, 798.

Zea Mais, *see* Maize.

Zebronia phenice on Cotton, 391.

Zilverdraadziekte, 1185.

Zinc, Arsenite of Zinc as an Insecticide, 392.

Zonocerus elegans on Tobacco, 690.

Zophosis sp. on Cotton and on Tobacco, 690.

B) INDEX OF AUTHORS.

BACCARINI, P., 181.
Baccarini Pasquale and Bargagli-Petrucci Gino, 1181.
Ballard, E., 690.
Bancroft, C. K., 796, 859, 860.
Bargagli-Petrucci, Gino, *see* Baccarini Pasquale.
Barsacq Jos., P., 393.
Beauverie, I., 73.
Bernatsky, J., 684.
Black, R. A., 287.
Blaringhem, L., 290.
Bodkin, G. E., 797, 865.
Bondarzew, A. S., 955.
Börner Carl, 799.
Braun, K., 785.
Brèthes Jean, 1079.
Bretschneider, A., 793.
Brittlebank, C. C., 1070.
Broili, J. and Schikorra, W., 74.
Brooks Charles, 1182.
Brooks, F. T., 1190.
Brown Nellie, A. and Jamieson Clara O., 478.
Brŏz, O., *see* Köck, G. and Kornauth, K.
Bubák, Fr., 788.
Burmeister Hermann, 1191.
Butler, E. J., 960.

CAMERON ALFRED E., 292.
Campbell Roy, E., 805.
Carpenter George, H., 86.
Cavara, F., 484.
Chiffiot, 1073.
Chittenden, F. H., 395, 396.
Chittenden, F. J., 957.
Cozzi Carlo, 486.
Cristofoletti, V., *see* Perotti, R.
Crosby, C. R. and Leonard, M. D., 692.

DANTONY, E., *see* Vermorel, V.
Darnell - Smith, G. P., 1065.
Dean George, A., 394.
Del Guercio Giacomo, 693, 1181.
Demolon, A., *see* Guerrapain, A.
De Rosa Antonio, 1197.
Désoil, P., 964.
Dupont, L., 971.
D'Utra Gustavo, *see* Hempel Adolpho.

ERIKSSON JAKOB, 182, 685, *pag. 1546.*

FAURE, J. C., 973.
Fawcett, G. L., 1185.
Field Ethel, C., *see* Harter, L. L.
Foex Etienne, 183.
Fonzes-Diacon, 954.
French, C. Junior, 88, 1083.
Friederichs, K., 869.
Froggatt Walter, W., 1082.
Fron, G., 184.
Fullaway, D. T., 1081.

GAUMONT, L., 296.
Gough Lewis, 970.
Gowdey, C. C., 293, 696.
Grassi, B., 966.

The figures in italics refer to the number of the page, the others to the number of the abstract.

Green E. Ernest, 798.
Green E. Ernest, *see* Lindinger, Leonhard.
Greene Charles, T., 591.
Greppi Carlo, 1188.
Gróf Béla, 1187.
Guerrapain, A. and Demolon, A., 77.
Guppy, P. L., 188.

HAMILTON, A. A., 187.
Hariot, P., 862.
Harter, L. L., 482.
Harter, L. L. and Field Ethel, C., 687.
Hartzell, F. Z., 398.
Headlee Thomas, J. and McColloch James Walker, 588.
Hempel Adolpho and D'Utra Gustavo, 803.
Hill, W. S., 791.
Hiltner, L., 575, 795.
Himmelbaur, W., 580.
Horne, A. S., 956.
Hove Van, 297.

ISTVANFFI, GY. DE, 857.
Ito Seiya, 481.

JAAP OTTO, 1183.
Jablonowski Jozsef, 192, *page 316.*
Jamieson Clara, C., *see* Brown, Nellie, A.
Jarvis, E., 868.
Johnson James, 794.
Jssleib, 488.

KAMENSKY, K., 82.
Köck, G., 1068.
Köck, G., Kornauth, K. and Brŏz, O., 858.
Kokujev Nikita, 1193.
Kornauth K., *see* Köch, G. and Brŏz, O.
Kränzlin, 194.
Kurdjumov, N., 294, 801.
Kuwana, S. I., 1192.

LECAILLON, 968.
Lederle, P., *see* Mach, F.
Lendner, Alf., 1189.
Leonard, M. D., *see* Crosby, C. R.
Leutz, J., von, 583.
Lindinger Leonhard and Green, E. Ernest, 967.
Long, W. H., 485.
Ludwigs Karl, 288.
Lüstner Gustav, 584, 586, 587.

MACH, F. and LEDERLE, P., 792.
Maffei Luigi, 186.
Malaquin, A. and Moitié, A., 800, 965.
Mameli Eva, 289, 576.
Marchal E., 76.
Marchal Paul, 85.
Marchi, C., *see* Passerini, N.
Marcolongo, I., 581.
Massee, G., 79.
Massee, I., 1067.
Maublanc, A. and Rangel, E., 78.
Mayné, R. and Vermoesen, 1060.
McColloch James Walker, *see* Headlee Thomas, J.
Milani, A., 694.
Miyake Ichiro, 578.
Moitié, A., *see* Malaquin, A.
Molz, E., 180.
Molz, E., *see* Müller, H. C.
Molz, E. and Pietsch, W., 691.
Molz, E. and Schröder, D., 1076.
Montemartini Luigi, 579.
Morettini, A., 81.
Morris, H. E., 959.
Müller, H. C. and Molz, E., 388, 389.
Müller, K., *see* Wahl, C. v.

NOEL PAUL, 295.
Northrup Zae, 864.
Novelli, N., 972.

OBERSTEIN, O., 75.
Osmaston, B. B., 1198.

PAILLOT, A., 84.
Paine, J. H., *see* Scott, E. W.
Parks, T. A., *see* Webster, F. M.
Parrot, P. J. and Schoene, W. J., 400.
Passerini, E. and Marchi, C., 80.
Peacock, A. D., 391.

Pée Laby, E., 686.
Perotti, R. and Cristofoletti, U., 688.
Petch, T., 285.
Petri, L., 480, 689.
Peyronel, B., *see* Saccardo, P. A.
Picard, F., 189.
Pierce, W. Dwight, 193.
Pietsch, W., *see* Molz, E.
Poli Polo, 951.
Poskin J., 76.
Prunet, A., 291.

RANGEL, E., *see* Maublanc, A.
Rankin, W. H., 1074.
Ranojevic, N., 1184.
Ravaz, L., 958.
Rigotard Marcel, 1085.
Rohwer, S. A., 802.
Rolland, B. G. C., 387, 390, 963.
Rutherford, A., 1084, 1194, 1195.

SACCARDO, P. A. and PEYRONEL, B., 861.
Salmon, E. S., 951.
Schander, R. and Tiesenhausen, M., 683.
Schikorra, W., *see* Broili, J.
Schoene, W. J., 392.
Schoene, W. J., *see* Parrot, P. J.
Schröder, D., *see* Molz, E.
Schwartz Martin, 397.
Scott, E. W. and Paine, J. H., 804.
Shaw, F. J. F. and Sundararaman, S., 961.
Silvestri, F., 190.
Sorauer, P., 786.
Stone, G. E., 191.
Sundararaman, S., *see* Shaw, F. J. F.
Swingle Deane, B., 952.
Sydow, H. and P., 787, 789, 790.

TIESENHAUSEN, M., *see* SCHANDER, R.
Topi, M., 969, 1078.
Trabut, L., 80.
Tullgren, A., *page 1410.*

URICH, F. W., 589.

VAN DYKE EDWIN, C., 1196.
Vayssière, P., 695, 697.
Vermoesen, 1071, 1072.
Vermoesen, *see* Mayné, R.
Vermorel, V. and Dantony, E., 1069.
Voglino, P., 590.
Vuillet, A., 487, 585.

WAGNER, 867.
Wahl, C. v. and Müller, K., 577.
Webster, F. M. and Parks, T. H., 87.
Weir James, R., 962, 1075.
Wenner, John J., 1186.
Wilson, H. F., 866.
Winkelmann, H., 386.
Wolf, A. Frederick, 582.
Woodworth, C. W., 399.

Acc No 5836